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NATIONAL DAM SAFETY PROGRAM. LAKE MEADE DAM (INVENTORY NUMBER V--ETC(U)
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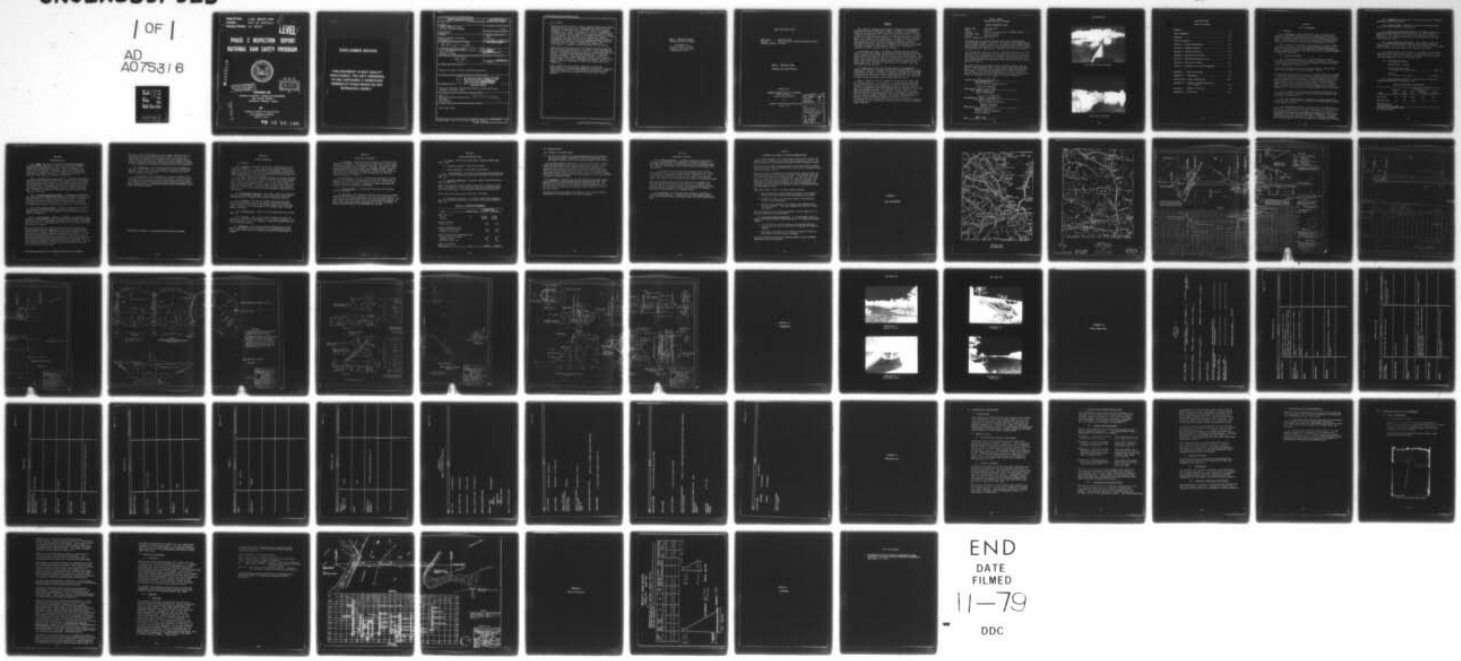

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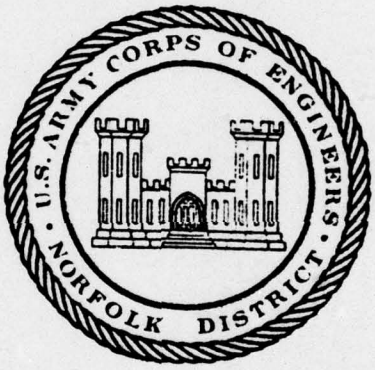
Name Of Dam: LAKE MEADE DAM
Location: CITY OF SUFFOLK
Inventory Number: VA. 80013

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

DEWARD M. MARTIN & ASSOCIATES
WILLIAMSBURG, VIRGINIA
AUGUST, 1979

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National Dam Safety Program

LAKE MEADE DAM
SUFFOLK, VA

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LAKE MEADE DAM
CITY OF SUFFOLK, VIRGINIA
(Formerly Nansemond County)
INVENTORY NO. 80013

LOWER JAMES RIVER BASIN

Name of Dam : Lake Meade Dam
Location : City of Suffolk (formerly Nansemond County)
Inventory Number: VA 80013

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Prepared for

NORFOLK DISTRICT CORPS OF ENGINEERS
803 Front Street
Norfolk, Virginia 23510

By

Deward M. Martin & Associates, Inc.
August 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Lake Meade Dam
State:	Virginia
County:	City of Suffolk (formerly Nansemond County)
USGS Quad Sheet:	Suffolk, Virginia
Stream:	Nansemond River
Date of Inspection:	May 7, 1979

Lake Meade Dam is a concrete structure 677.5 feet long including an ogee shaped spillway of 530 feet. The dam is 33 feet high from the top of the dam to the streambed. It is located at the northern tip of Suffolk about 1,500 feet west of State Route 10/32 and 4,000 feet north of State Route 58. The structure is owned by the City of Portsmouth.

The spillway will pass 22% of the PMF. The water depth will reach 4.2 feet over the top of the dam, with a velocity of 11.6 f.p.s. The dam is stable from overturning forces although the horizontal thrust resisted by the piles in bending was questioned. However, when contacted, the original designer confirmed the suitability of the design to resist horizontal thrust.

The visual inspection revealed no major problems, however, some leakage was noted along the joints in the concrete panels near both abutments. Action should be taken to repair these joints and eliminate the leakage. It is further recommended that the dam be modified to pass the PMF without endangering the structure and that a warning procedure be established to alert residents in time of emergency.

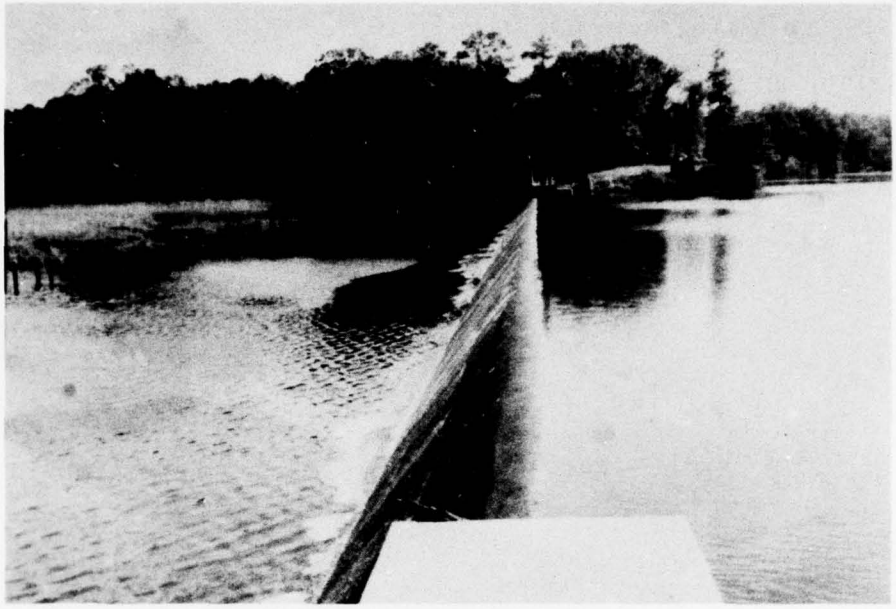
Prepared By: Paul Seiler
PAUL SEILER, P.E.
Deward M. Martin & Associates, Inc.

ORIGINAL SIGNED BY:
Submitted By: JOHN E. KENNEDY
for JAMES A. WALSH, P.E.
Chief, Design Branch

ORIGINAL SIGNED BY:
Recommended By: CARL S. ANDERSON, JR.
for JACK G. STARR, P.E.
Chief, Engineering Division

Original signed by:
Approved By: Douglas L. Haller
DOUGLAS L. HALLER
Colonel, Corps of Engineers
District Engineer

Date SEP 17 1979



Top View of Concrete Spillway

Front View of Spillway

LAKE MEADE DAM

TABLE OF CONTENTS

SECTION 1

PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 Aug 72 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I Inspection according to the Recommended Guidelines for Safety Inspection of Dams (Appendix VI, Reference 1). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Lake Meade Dam is a concrete structure 677.5 feet in length from abutment to abutment. The dam is 33 feet high from the top of the dam at elevation 17 to the low point in the streambed at elevation -16.0.

The spillway is made of concrete and is ogee shaped. The spillway crest is at elevation 12 and has a length of 530 feet.

A drawing detailing the draw-off tower is included as Plate 5, Appendix I. The tower is located 150 feet from the right abutment and is used to lower the level of the reservoir. A 60-inch diameter pipe with an invert elevation of 0.0 extends from the tower through the dam to the outlet channel. Water enters the tower through a 48-inch diameter opening which can be opened and closed manually by means of a sluice gate. A second 36-inch diameter opening is located in the tower at elevation 6.5. This opening is also operated manually by a sluice gate.

1.2.2 Location: Lake Meade Dam is located at the Northern tip of Suffolk City about 1,500 feet west of State Route 10/32 and 4,000 feet north of State Route 58.

1.2.3 Size Classification: The dam has a storage capacity of 6,436 acre-feet. Therefore it is classified as intermediate according to the storage capacity.

1.2.4 Hazard Classification: The dam is located 2,500 feet upstream from U S Route 460 and a group of 13 houses. The classification of this dam is high hazard in accordance with Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams, published by the Department of the Army, Office of the Chief of Engineers. The hazard classification used to categorize the dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: Lake Meade Dam is owned by the City of Portsmouth, Department of Public Utilities.

1.2.6 Purpose of Dam: Lake Meade is used for the water supply for the City of Portsmouth treatment plant.

1.2.7 Design and Construction History: The dam was designed by Kenneth Weeks, Engineers of Norfolk, Virginia, in 1958 and was constructed in 1959. Plans are available in the files of the City of Portsmouth. No information was available on construction of the dam such as concrete tests.

1.2.8 Normal Operational Procedure: This dam has a manual control to discharge water below the spillway crest through a 60-inch diameter pipe. Treatment water is not taken from the lake in the vicinity of the dam and is not involved in this inspection and report.

1.3 Pertinent Data: The dam controls a drainage area comprising Lake Kilby, Lake Cohoon and Lake Meade. The drainage areas are: Lake Kilby 22.2 square miles, Lake Cohoon 33.3 square miles and Lake Meade 8.7 square miles or a total of 64.2 square miles.

1.3.2 Discharge at Dam Site:

Maximum Flood - Unknown.

One 60-inch outlet pipe
pool level at spillway crest . . . . . 252 c.f.s.

Spillway
pool level at top of dam . . . . . .14,400 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet m.s.l.	Reservoir Area, acres	Reservoir Capacity Acre, feet	Reservoir Capacity Watershed, inches (a)	Length, miles (b)
Top of Dam	17	680	6,436	13.9	2.8
Spillway Crest	12	590	3,486	7.5	2.8
Streambed at the toe of the dam	-16+				

(a) Based on 8.68 square miles
(b) To Lake Cohoon

SECTION 2

ENGINEERING DATA

2.1 Design: The plans and specifications were prepared by R. Kenneth Weeks, Engineers, in 1958 for the City of Portsmouth. These plans include plans, sections, borings and appear to be complete and professionally prepared. Design calculations, however, were not available. A physical inspection of this dam was performed in September 1978 by J. K. Timmons and Associates. An excerpt of this report is included in Appendix IV.

*2.1.1 Geologic Setting of the Dam Site: The dam is located in the Coastal Plain geologic province and is underlain by the Yorktown Formation of Miocene geologic age. The Yorktown consists generally of preconsolidated marine sand, clay and broken shell material known locally as "marl". Surrounding hilltops of the immediate dam area are probably capped with the Sedley formation of Pliocene geologic age. The Sedley is composed of fine sand and silty sand with thin layers of silty clay.

*2.1.2 Available Geotechnical Data: A subsurface investigation was conducted by R. Kenneth Weeks, Engineers of Norfolk, Virginia, in conjunction with the original construction of the dam. A plan and profile of the dam, showing soil test borings and their locations is given on Plate No. 1 in Appendix IV. A detailed description of the subsurface conditions is given in Section C.2.c.1. of Appendix IV.

*2.1.3 Previous Inspections: A physical inspection of the dam was conducted in September 1978 by engineering personnel from J. K. Timmons & Associates. A brief summary of their findings is given on Page 12 of Appendix IV.

*2.1.4 Dam Foundation: Subsurface conditions at the dam site consisted of soft gray organic silt and peat, loose to firm gray fine sand and loose to firm gray and brown fine sandy clay, and sand to elevations as low as -29 m.s.l. Underlying these soils is a gray fine silty sand with a trace of shells.

*The dam is supported on a cofferdam constructed of 18 semicircular steel sheeted cells with diaphragms 30.5 feet long and two end cells about 62 feet in length. These cells penetrate to elevation - 56.5 with the top of cells at elevation +8 and provide a cutoff. The cells penetrate a minimum of 29 feet into the "marl". The concrete cutoff walls extend into the abutments a distance of 79 feet on the right end and 59 feet in the left end. These walls extend to elevation - 20. Each cell also contains 60 timber piles with 20 ton capacity. Pile tips were required to penetrate to about elevation -56.6 or the same tip grade as the cellular cofferdam.

*Information provided by Law Engineering Associates of Virginia.

*In order to insure the stability of the cellular cofferdam wall, all soft marsh soils and the underlying loose sands of Strata A and B, respectively, as defined in the Timmons report, were dredged from within the cells and also to a distance of 30 feet upstream and downstream. Dredging was required to the surface of the "marl" of Stratum D. This excavated area was then backfilled with sand to elevation -6.

2.2 Construction: Construction records were not available for this dam. Construction plans and drawings of the dam are included in Appendix I and a brief description of the dam foundation and cutoff wall is included in Appendix IV.

2.3 Evaluation: The dam appears to be properly designed under the direction of a qualified professional engineer. The face that the soft marsh soils and loose sands were removed from within and around the cofferdam walls and backfilled with sand indicates that the cofferdam is stable, however, construction records were not available to provide a thorough evaluation.

*Information provided by Law Engineering Associates of Virginia.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the May 7, 1979 inspection are recorded in Appendix I. At the time of the inspection the pool elevation was 12.0 m.s.l., or about normal pool elevation. There was an inspection report available, done by J. K. Timmons and Associates in 1978 (See Appendix IV). The area surrounding the dam was in good condition except as noted in 3.1.6 below.

3.1.2 Dam: There was no obvious horizontal or vertical misalignment in the dam. There were no cracks or erosion around the junction of the concrete dam and the abutments. There were white stains and joint leaks on the downstream side of the concrete panels next to the right and left abutments. Near the center of the spillway there are joints or spallings at the surface causing the water flow to jump an inch more or less. There was no observed movement of abutments or of the spillway.

3.1.3 Appurtenant Structures: The manual control tower appeared to be in good operating condition. White stains were noted on the downstream side of the panel below the valve operating platform.

3.1.4 Spillway: The concrete spillway, which did not have water flowing over the crest at the time of inspection, had white stains and minor joint leaks on the concrete panels next to the right and left abutments. Near the middle of the spillway there are some surface spallings.

3.1.5 Instrumentation: There is no instrumentation for the Lake Meade Dam.

3.1.6 Reservoir: The reservoir area is heavily forrested and fairly flat. Two holes, approximately 8 to 10 inches in diameter, were noticed northeast of the left abutment. These were probably the result of burrowing animals.

3.2 Evaluation: The visual inspection indicated that the dam was in a good state of repair, however, it is recommended that the owner repair those joints in the spillway which are showing signs of leakage.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure: The normal pool elevation is 12.0 which is the crest of the spillway. The dam is used to supply water to the treatment plant for the City of Portsmouth, Virginia. Water can be manually routed through the dam by means of a manually operated gate valve which controls the 60-inch diameter pipe through the dam. Normal procedure by the Portsmouth Department of Public Utilities calls for the valve to be opened when the water passing over the spillway reaches a depth of 15 inches.

4.2 Maintenance: The City of Portsmouth, Department of Public Utilities is responsible for maintenance of the dam. Maintenance is primarily concerned with insuring that the area is cleaned and that the gate valve is operational. A program to repair the joints and leaks is now being considered by the owner.

4.3 Warning System: At the present time there is no warning system in operation.

4.4 Evaluation: The Lake Meade Dam does not require an extensive operation and maintenance program and, from the visual inspection, it appeared that the routine maintenance was being performed properly. The owner should, however, conduct a more thorough inspection annually to detect and correct more serious problems such as leaks and cracks. A warning system should also be established for the dam.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Construction plans from R. Kenneth Weeks, dated April, 1958.

5.2 Hydrologic Records: None were available.

5.3 Flood Experience: No records were available.

5.4 Flood Potential: The PMF and 1/2 PMF were routed through the reservoir. Hydraulic routing and data were furnished by the Corps of Engineers.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1.

Water flows through a 60-inch diameter pipe which is integral to the dam at elevation 0.0. Water also flows past the dam over the spillway in the event water in the reservoir rises above elevation 12.0.

Rating curves were generated by the Corps of Engineers.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance is shown in Table 5.1.

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal flow	Hydrograph 1/2 PMF	Hydrograph PMF (c)
Peak Flow c.f.s.			
Inflow	9	32,300	67,100
Outflow	--	31,800	66,500
Maximum elevation feet, m.s.l.		19.9	24.0
Spillway (elevation 12.0)			
Depth of flow, feet (a)		5.5	8.1
Velocity, f.p.s. (b)		13.3	16.1
Non-overflow Section (elevation 17.0)			
Depth of flow, feet (a)		1.9	4.2
Duration, hours		16	24
Velocity, f.p.s. (b)		7.8	11.6
Tailwater elevation, Feet, m.s.l.	0+	12.6+	18.4 +

(a) Critical depth

(b) Velocity at critical depth

(c) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

5.7 Reservoir Emptying Potential: A 36-inch sluice gate, circular opening at elevation 6.5 and a 48-inch sluice gate, circular opening at 2.0 in the Draw Off Tower in the Lake Meade are available for dewatering the reservoir. The gates will permit withdrawal of about 252 c.f.s. with the reservoir level at the crest of the spillway and essentially dewater the reservoir in about 18 days. A 60-inch diameter pipe with an invert elevation of 0.0 runs from the draw-off tower through the dam to the outlet channel.

5.8 Evaluation: Based on the size (intermediate) and hazard (high) classifications, the recommended Spillway Design Flood is PMF. The spillway will pass 22% of the PMF without overtopping the dam. The PMF will overtop the dam for 24 hours and reach a maximum of 4.2 feet over the top of the dam, with an average critical velocity of 11.6 feet per second.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

STRUCTURAL STABILITY

6.1 Stability Analyses: A stability analysis was prepared by Mr. Weeks for the design. The inspection and review of plans by J. K. Timmons and Associates in 1978 found no need for a stability analysis. However, the original design calculations are not available for confirmation.

The concrete dam is supported on wooden piles and by 18 steel sheeted cells extending from elevation +8 to -56.6. The piles are driven to a capacity of 20 tons to about elevation -56.6. The piles resist the overturning moment and the passive earth pressure inside, and outside the steel sheeted cells resist the horizontal forces.

The pile analysis indicated the loads applied are a maximum of 34 kips compared to 40 kips capacity of each pile. The passive earth pressure capacity resisting the applied horizontal loads is not known with the numerical exactness, however, the resistance is adequate according to the designer, Mr. R. Kenneth Weeks.

6.2 Evaluation: The dam appears to be stable, according to all information available. However, the back fill material adjacent to the sheet piling should be analyzed to get the actual possible pressure.

SECTION 7

ASSESSMENT AND REMEDIAL MEASURES/RECOMMENDATIONS

7.1 Dam Assessment: The design plans and the Phase I Report performed by J. K. Timmons and Associates were available for review. Design calculations and construction records were not available, however.

The dam is stable against overturning due to the piles and the passive resistance of the earth pressure on the cellular steel cofferdams resisting the horizontal thrust.

Based on the size (intermediate) and hazard (high) classification, the recommended Spillway Design Flood is the PMF. the spillway will pass 22% of the PMF without overtopping the dam. The PMF will overtop the dam for 24 hours and reach a maximum of 4.2 feet over the top of the dam, with an average critical velocity of 11.6 feet per second. In accordance with guidelines provided by the Corps of Engineers, the spillway is rated as inadequate because it will not pass the SDF without overtopping the dam.

Other deficiencies noted in the visual inspection were:

a. White stains were observed along the length of the concrete spillway indicating areas where seepage may have occurred.

b. Seepage was noted in the concrete joints on the spillway, adjacent to both abutments.

c. Two holes were observed on the banks of the reservoir near the left abutment. These were probably the result of burrowing animals.

With the exception of the above deficiencies, the dam appeared to be in good condition and well maintained.

7.2 Recommended Remedial Measures: It is recommended within 12 months that the following items be addressed in the regular maintenance program:

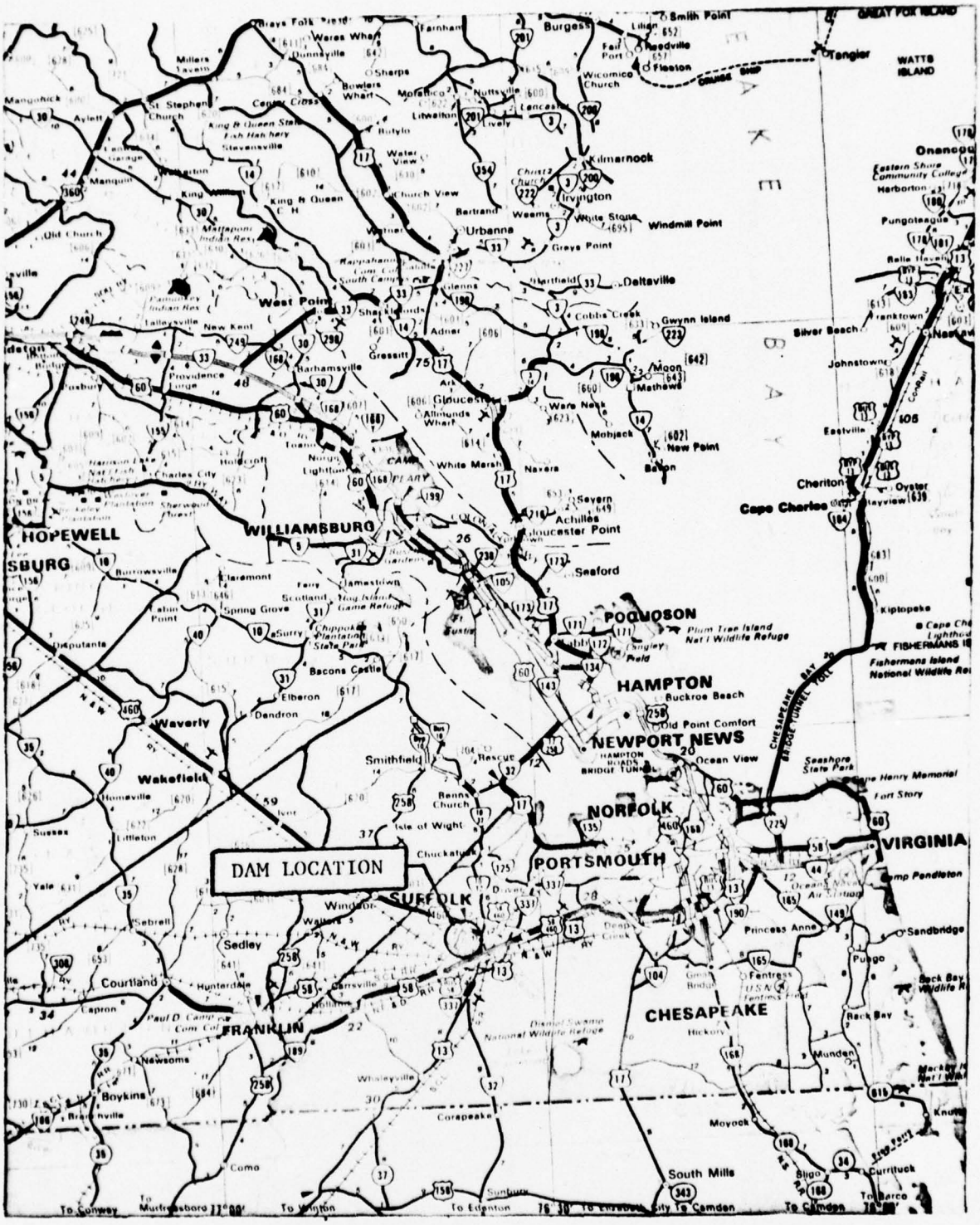
a. The leaks in the concrete joints on the spillway should be repaired and the white stains should be observed for signs of leakage.

b. The holes in the banks of the reservoir should be filled in and packed to prevent piping or seepage.

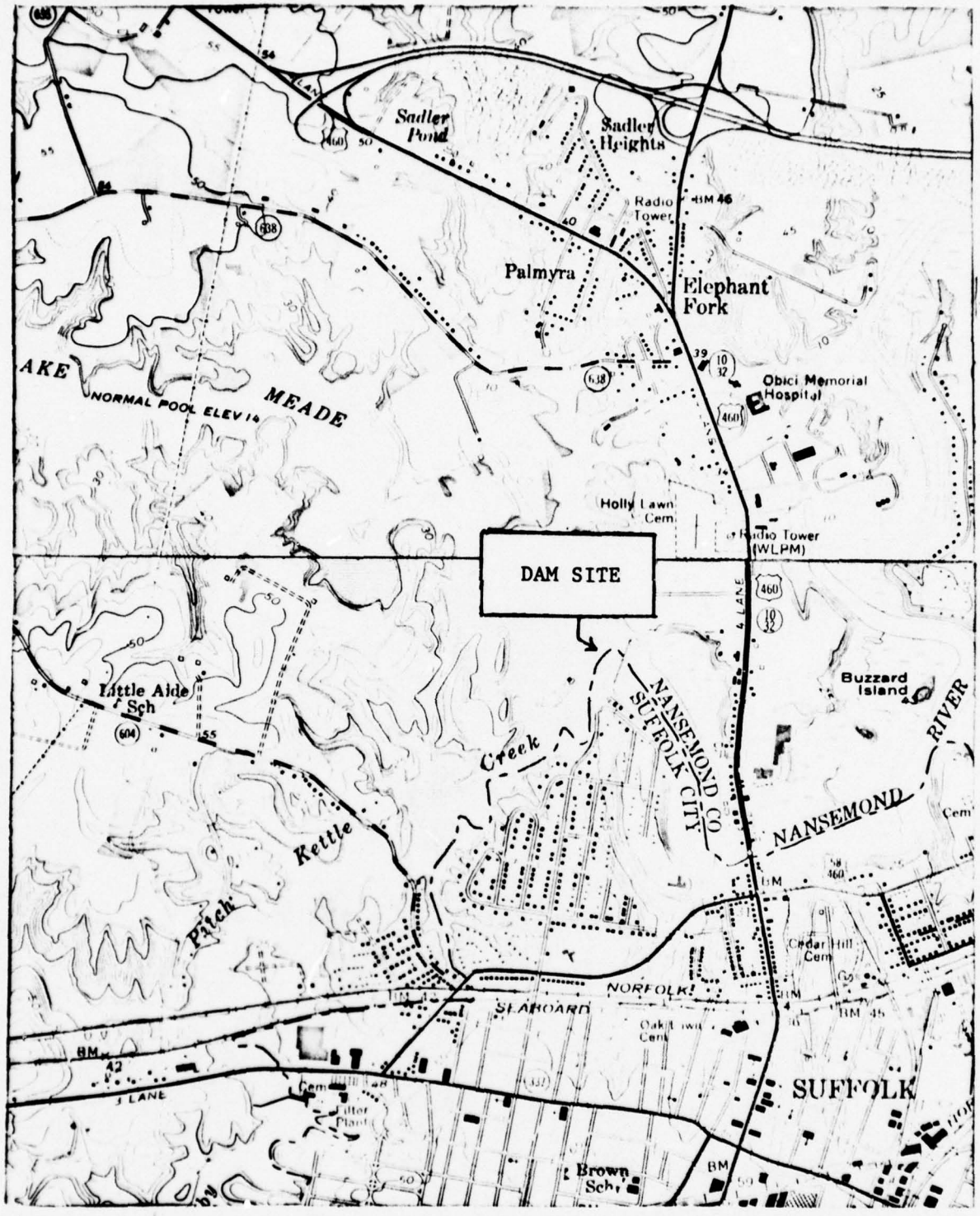
The owner should also establish a warning system to alert residents downstream in case of emergency.

APPENDIX I

MAPS AND DRAWINGS



REGIONAL MAP
LAKE MEADE DAM

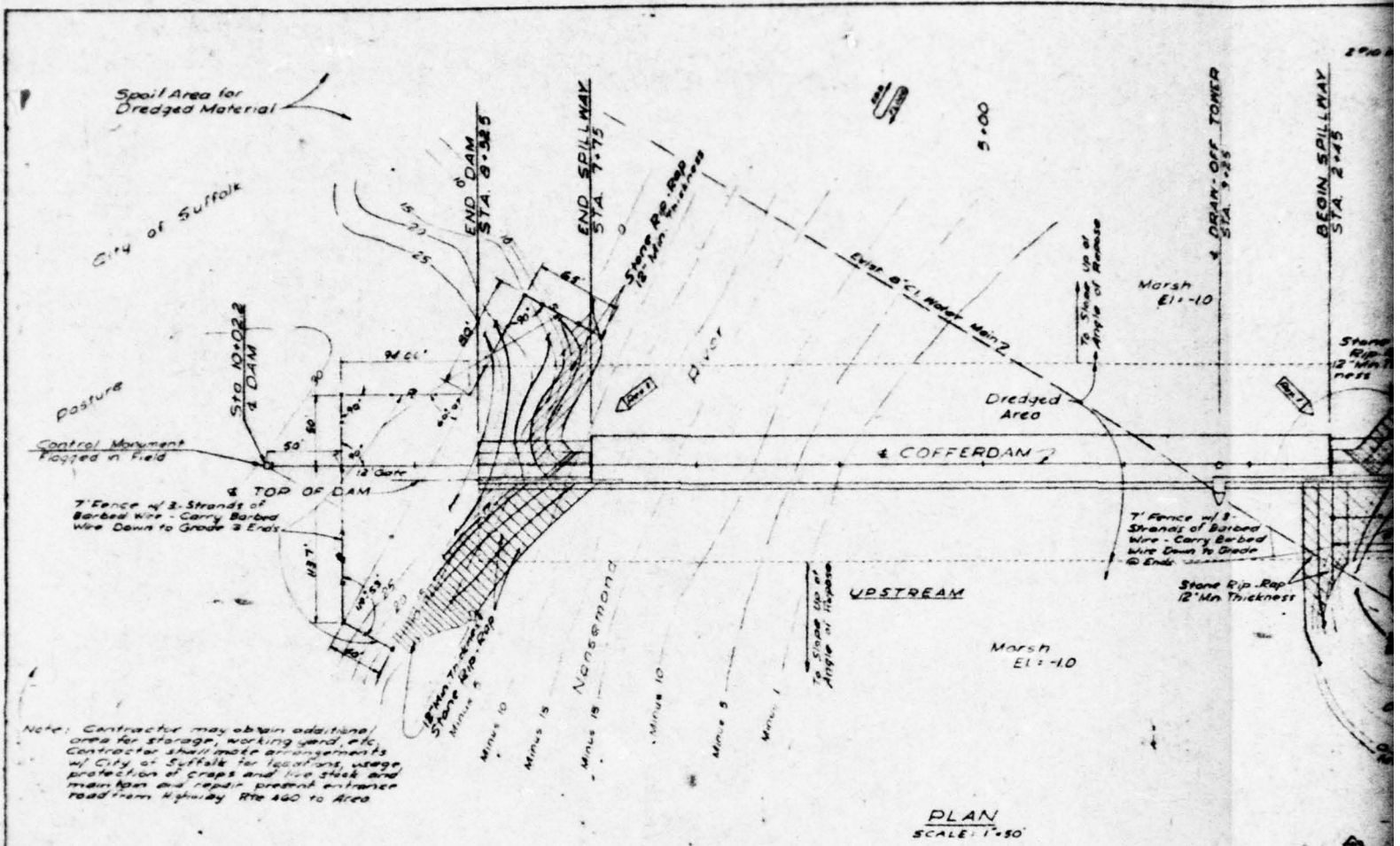


UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

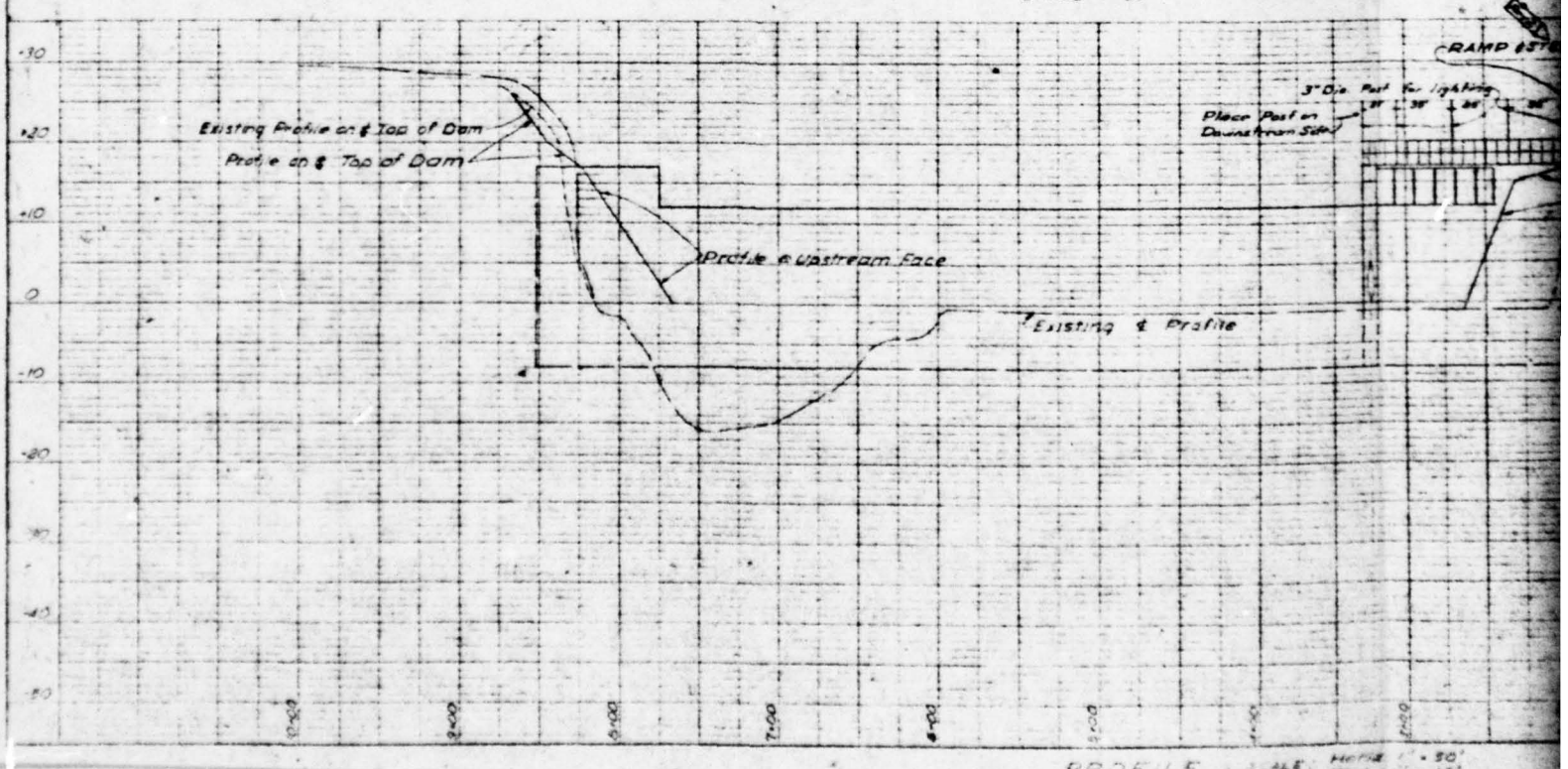
scale 1"=2000'
10' contours

SUFFOLK, VA.
NE/4 SUFFOLK 15' QUADRANGLE
N3637.5 - W7630/7.5
1954
PHOTOREVISED 1968
AMS 5657 II NE SERIES V834

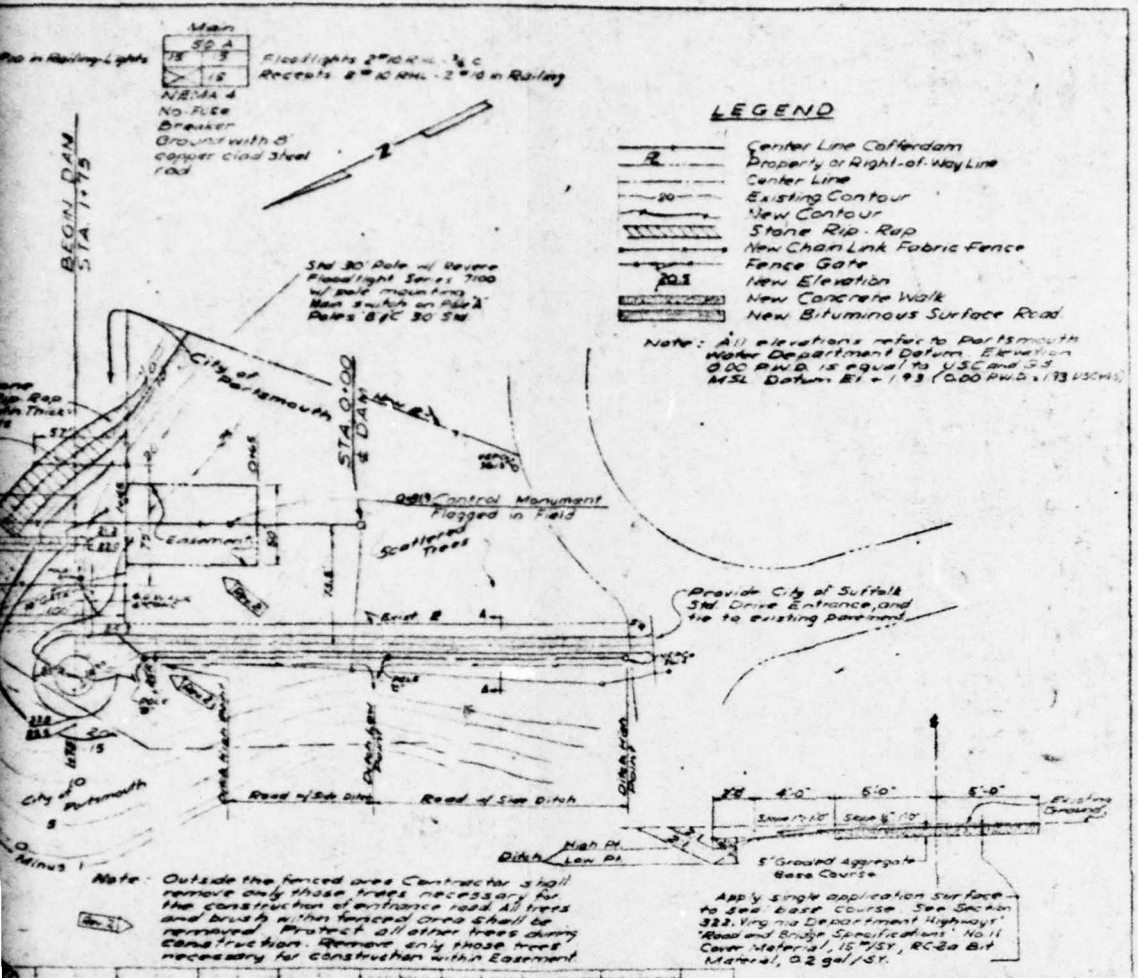
VICINITY MAP
LAKE MEADE DAM
LAKE MEADE



PLAN
SCALE: 1"=50'



PROFILE SCALE: Horiz. 1" = 50'
Vert. 1" = 10'



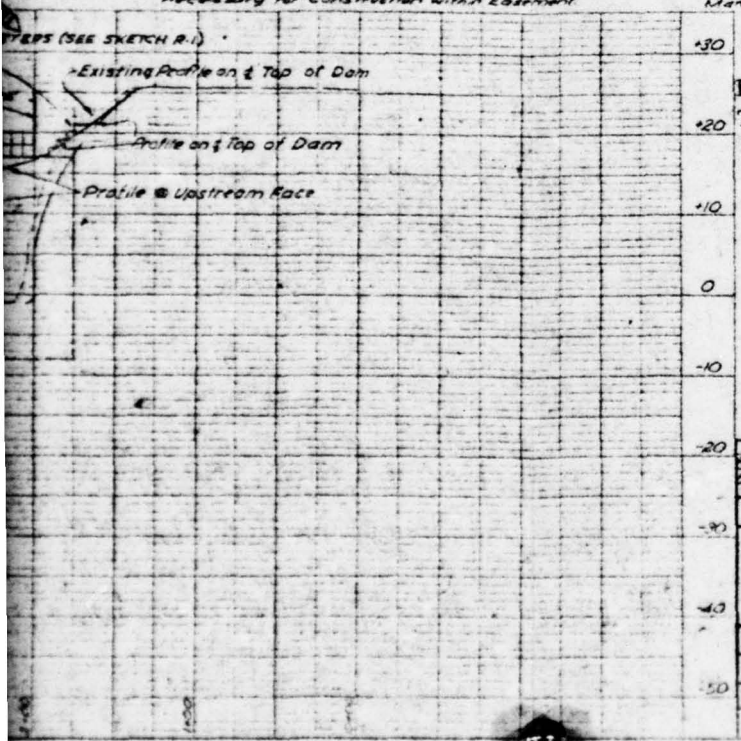
LEGEND

- Center Line Cofferdam
- Property or Right-of-Way Line
- Center Line
- 20 — Existing Contour
- New Contour
- Stone Rip-Rap
- New Chain Link Fabric Fence
- Fence Gate
- 20.1 New Elevation
- New Concrete Walk
- New Bituminous Surface Road

Note: All elevations refer to Portsmouth Water Department Datum. Elevation 0.00 P.W.D. is equal to U.S.C. and G.S. M.S.L. Datum El + 1.93 (0.00 P.W.D. = 1.93 USC&GS)

ROAD SECTION A-A

SCALE 1/4" = 1'-0"



PLANS ARE NOT TO SCALE

PLATE NO. 1

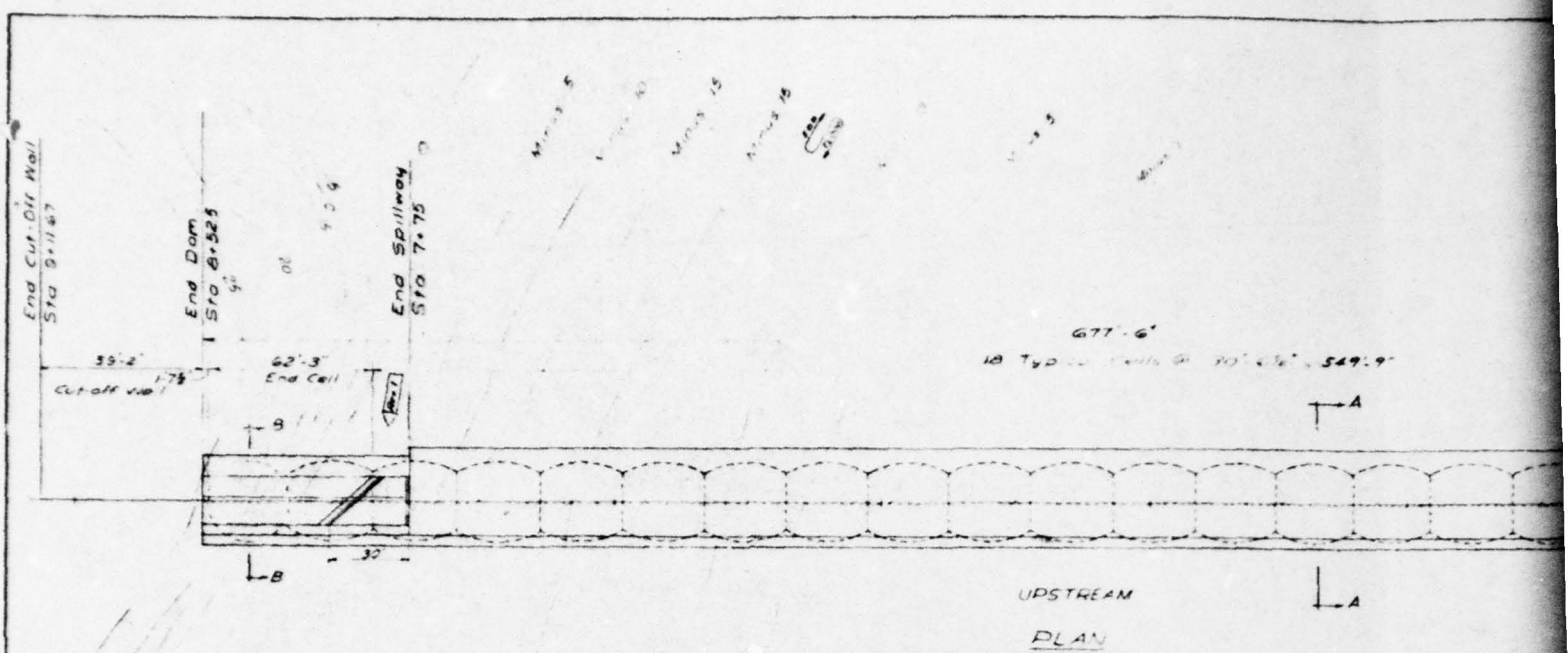
PORTSMOUTH WATER DEPARTMENT

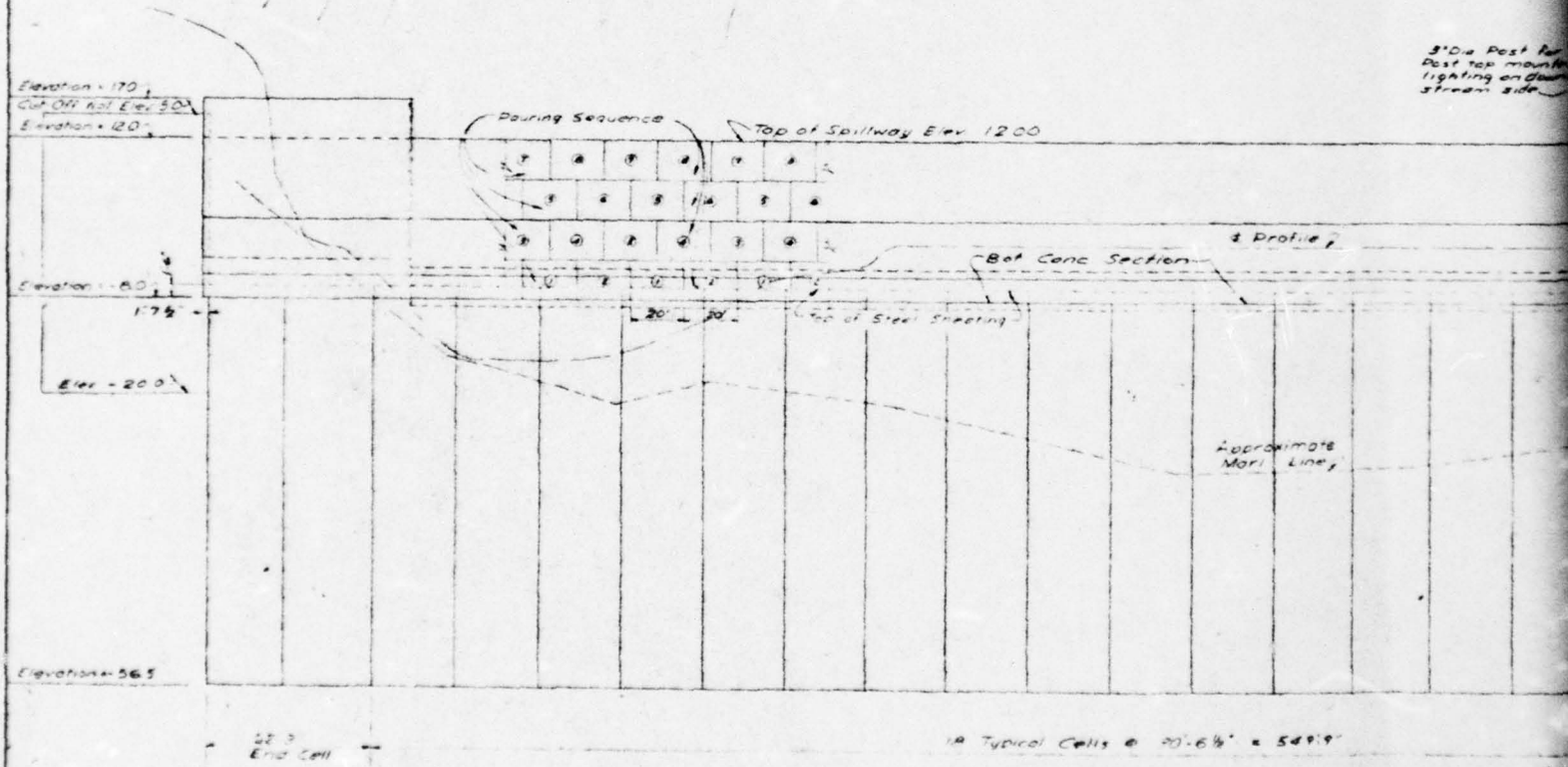
LAKE MEADE DAM

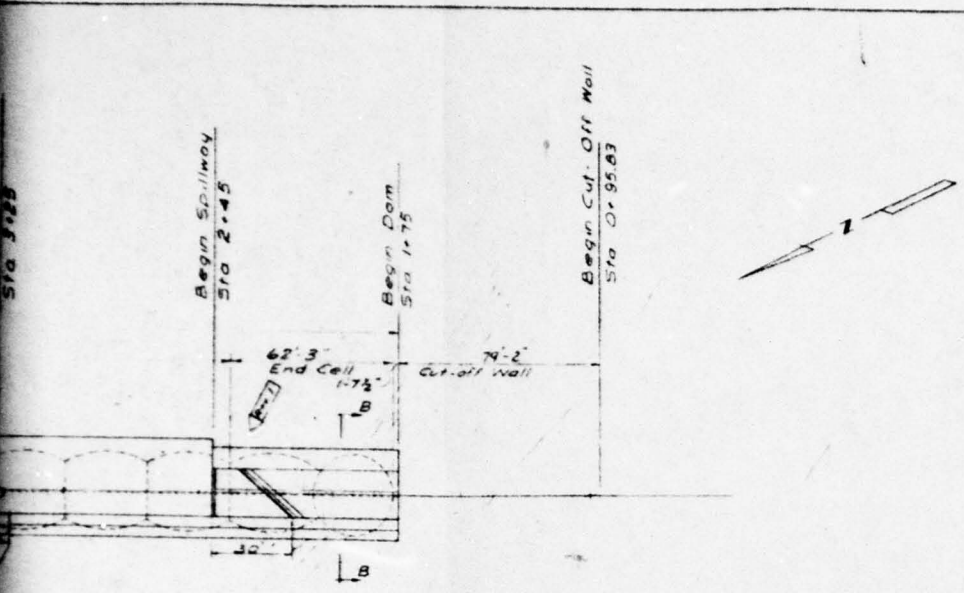
SITE PLAN

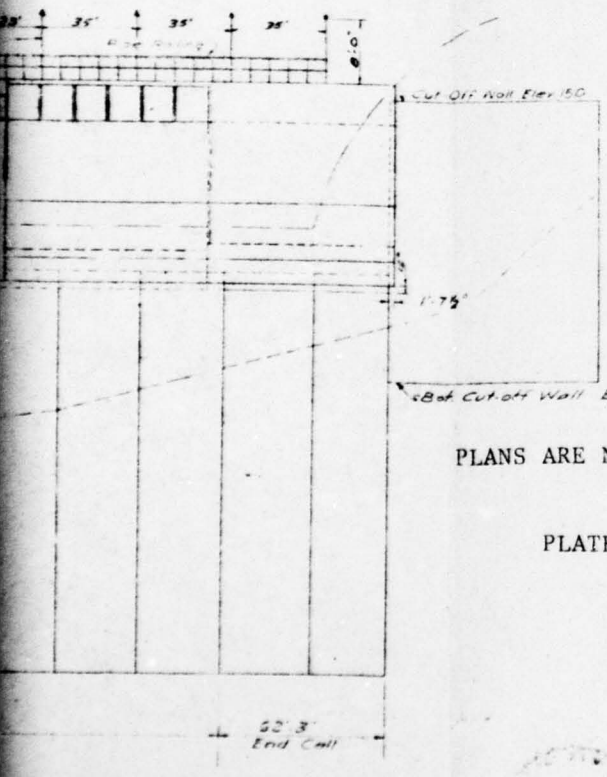
DES. WDM	R. KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA	SCALE AS NOTED
DRN. WDM		
CHK. RKW	CONTRACT "A"	
DATE APRIL 1958		

LAKE MEADE DAM AND RESERVOIR


End Cut-Off Wall
Sta 9+11.67
End Dam
Sta 8+52.5
End Spillway
Sta 7+75
39'-2"
Cut-off Wall
62'-3"
End Cell
677'-6"
18 Typ
549'-9"
A
B
30'
UPSTREAM
PLAN


Elevation 170'
Cut Off Wall Elev 150'
Elevation 120'
Pouring Sequence
Top of Spillway Elev 1200
℄ Profile
℄ of Conc Section
Elevation 80'
1:1½
20'
20'
Toe of Steel Sheeting
Elev 20.0'
Approximate Mud Line
Elevation 36.5
62'-3"
End Cell
18 Typical Cells @ 30'-6½" = 549'9"
UPSTREAM ELEVATION





NOTES

1. For Sections A-A, B-B and C-C see Drawing No 6.

PLANS ARE NOT TO SCALE

PLATE NO. 2

PORTSMOUTH WATER DEPARTMENT

LAKE MEADE DAM

STRUCTURAL

PLAN AND ELEVATION

DES. WDM | DRN. GRW | CHK. RKW | APP'D. TRB

R. KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA

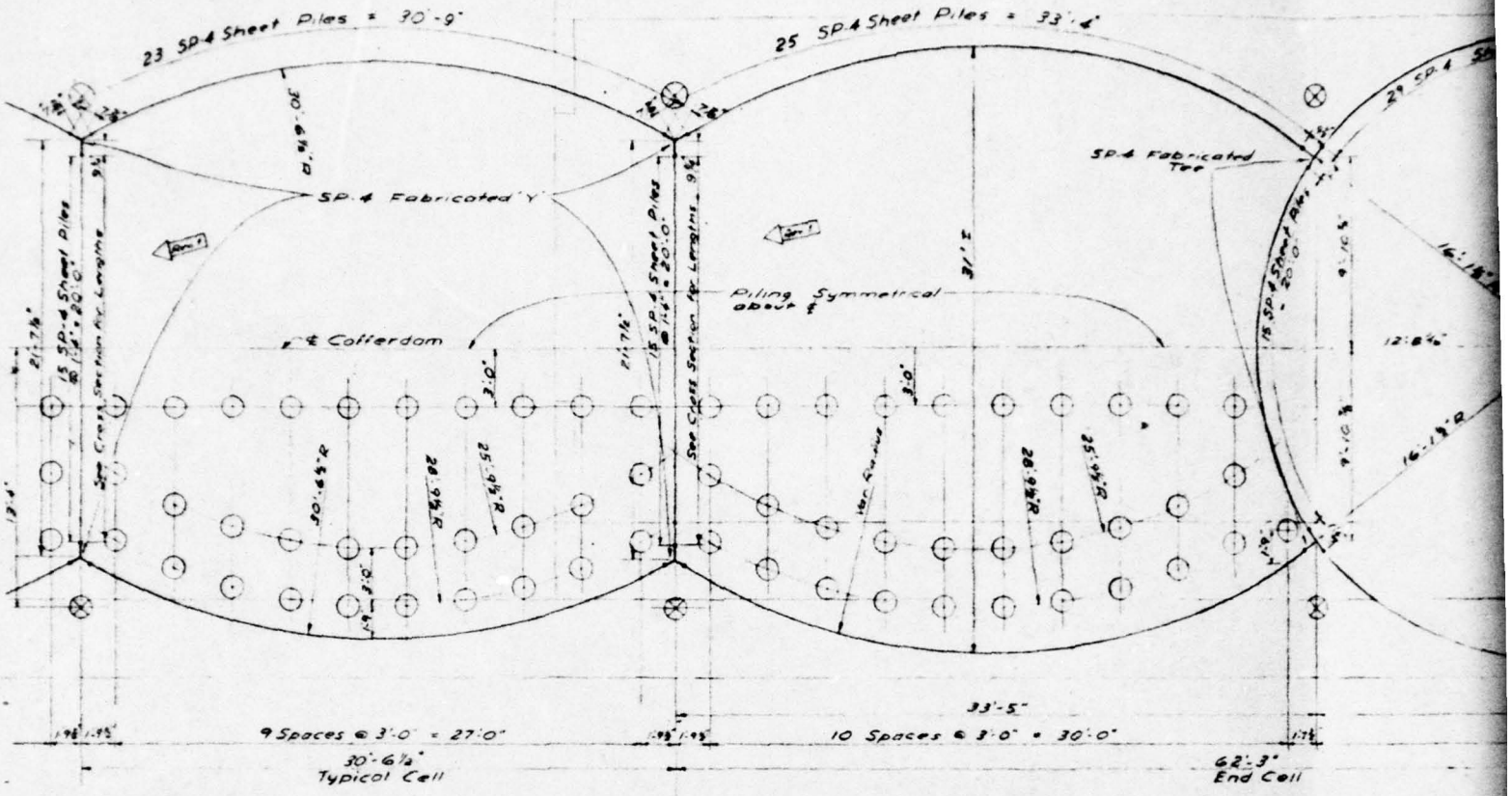
CONTRACT "A"

DRG. NO. 4

FILE NO. 1564

LAKE MEADE DAM AND RESERVOIR

2

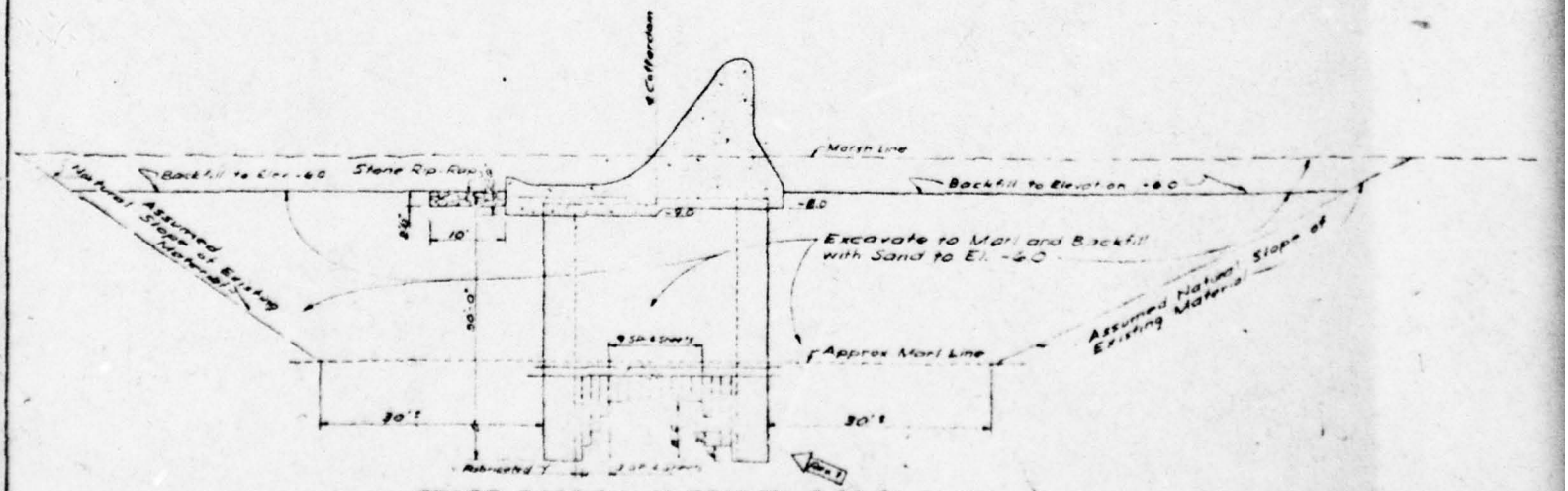


○ – Untreated Timber Pile

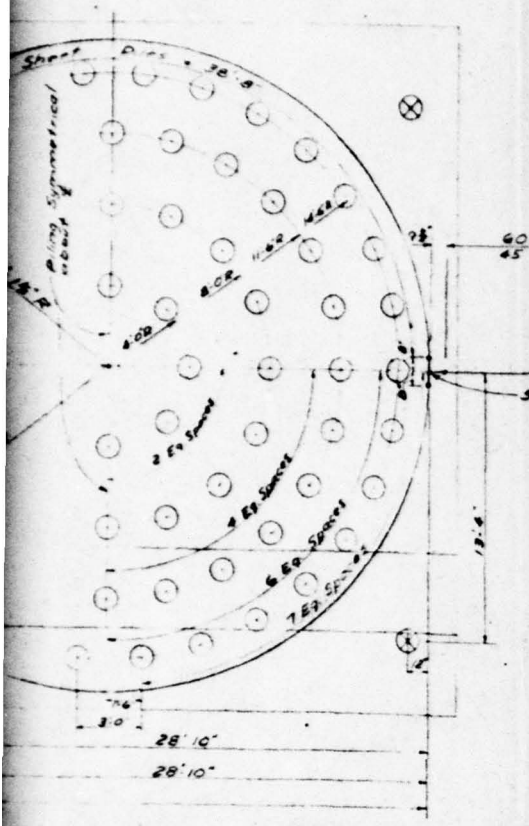
⊗ – Treated Timber Pile

PLAN
COFFERDAM AND PILING
(SOUTH END CELL w/ TYPICAL CELL SHOWN)

SCALE: ¼" = 1'-0"



CROSS SECTION AT STATION 5+00 (TYPICAL)



60 SP-4 Sheet Piles @ 16" = 80'0" South End
45 SP-4 Sheet Piles @ 16" = 60'0" North End

SP-4 Fabricated Tee

NOTES

1. Timber piles shall be driven to a minimum bearing capacity of 20 Tons, and prior to any backfilling Assured average penetration below cut-off 50 feet.
2. Dredging and backfilling shall be accomplished so that at no time will there be more than a 5 ft. differential between the material inside the cofferdam and the material outside the cofferdam.
3. Dredging and backfilling may be accomplished in any manner that will insure a minimum width of 30 ft. of sand backfill on each side of the cofferdam throughout the total height of the cofferdam above the marl line.

PLANS ARE NOT TO SCALE

PLATE NO. 3

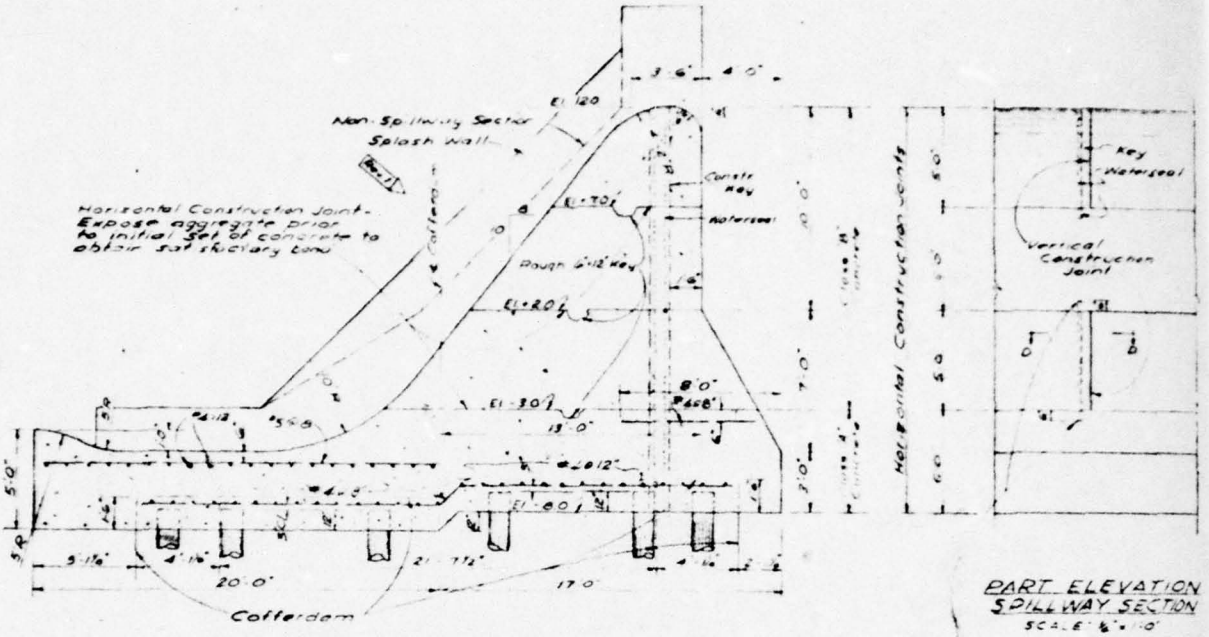
PORTSMOUTH WATER DEPARTMENT

LAKE MEADE DAM
STRUCTURAL
SUBSTRUCTURE

DES. RKW	R. KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA	SCALE
DRN. WCM GRW		
CHK. RKW	CONTRACT "A"	DWG. NO. 5
DATE		

LAKE MEADE DAM AND RESERVOIR

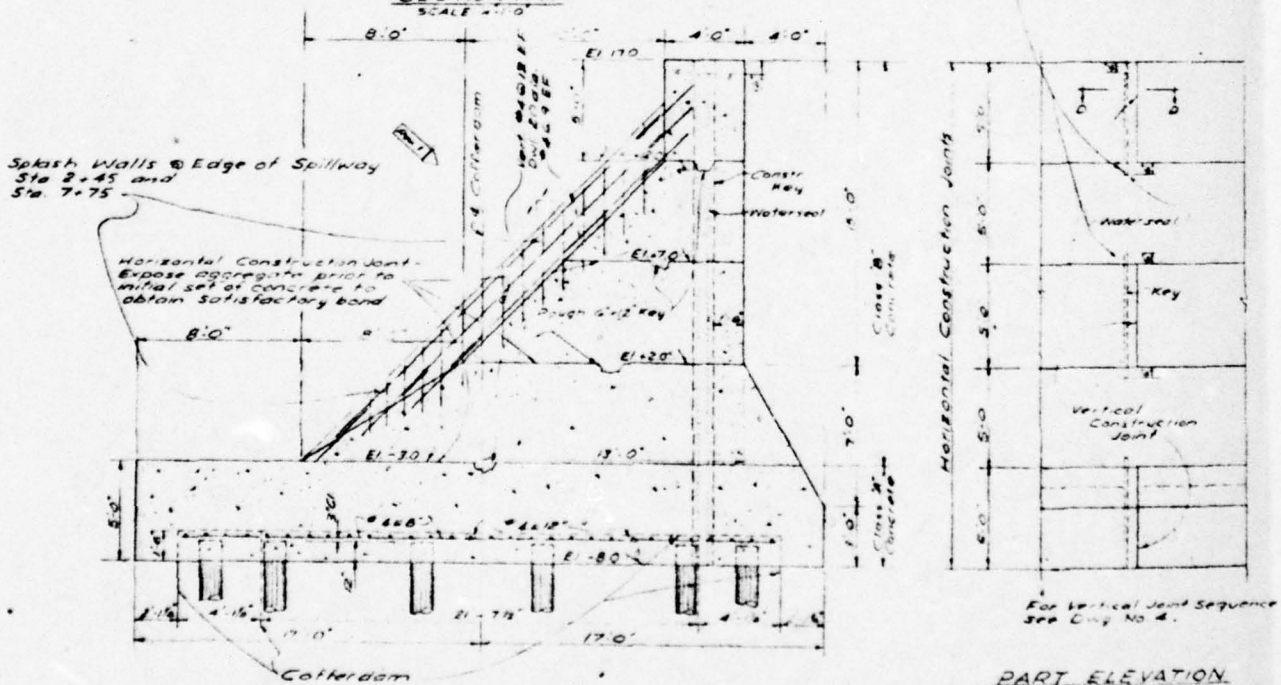
2



SPILLWAY SECTION
SECTION A-A
SCALE 1"=10'

PART ELEVATION
SPILLWAY SECTION
SCALE 1/8"=1'0"

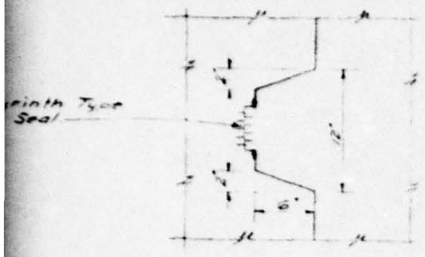
Extend Waterseal 6" min. into adjacent vertical pours



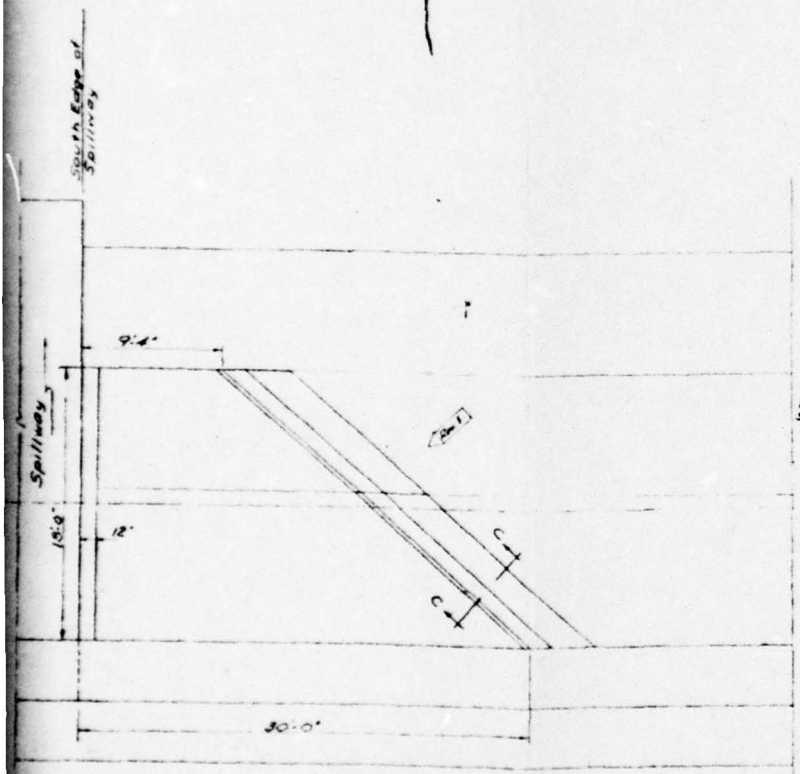
NON-SPILLWAY SECTION
SECTION B-B
SCALE 1"=10'

PART ELEVATION
NON-SPILLWAY SECTION
SCALE 1/8"=1'0"

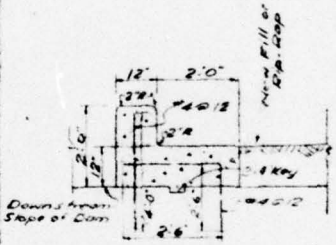
For Vertical Joint Sequence See Dwg. No 4.



SECTION D-D
(TYPICAL VERTICAL CONSTRUCTION JOINT)
SCALE 1"=1'-0"



South End Shown
North End Similar



SECTION C-C
SCALE 1/2"=1'-0"

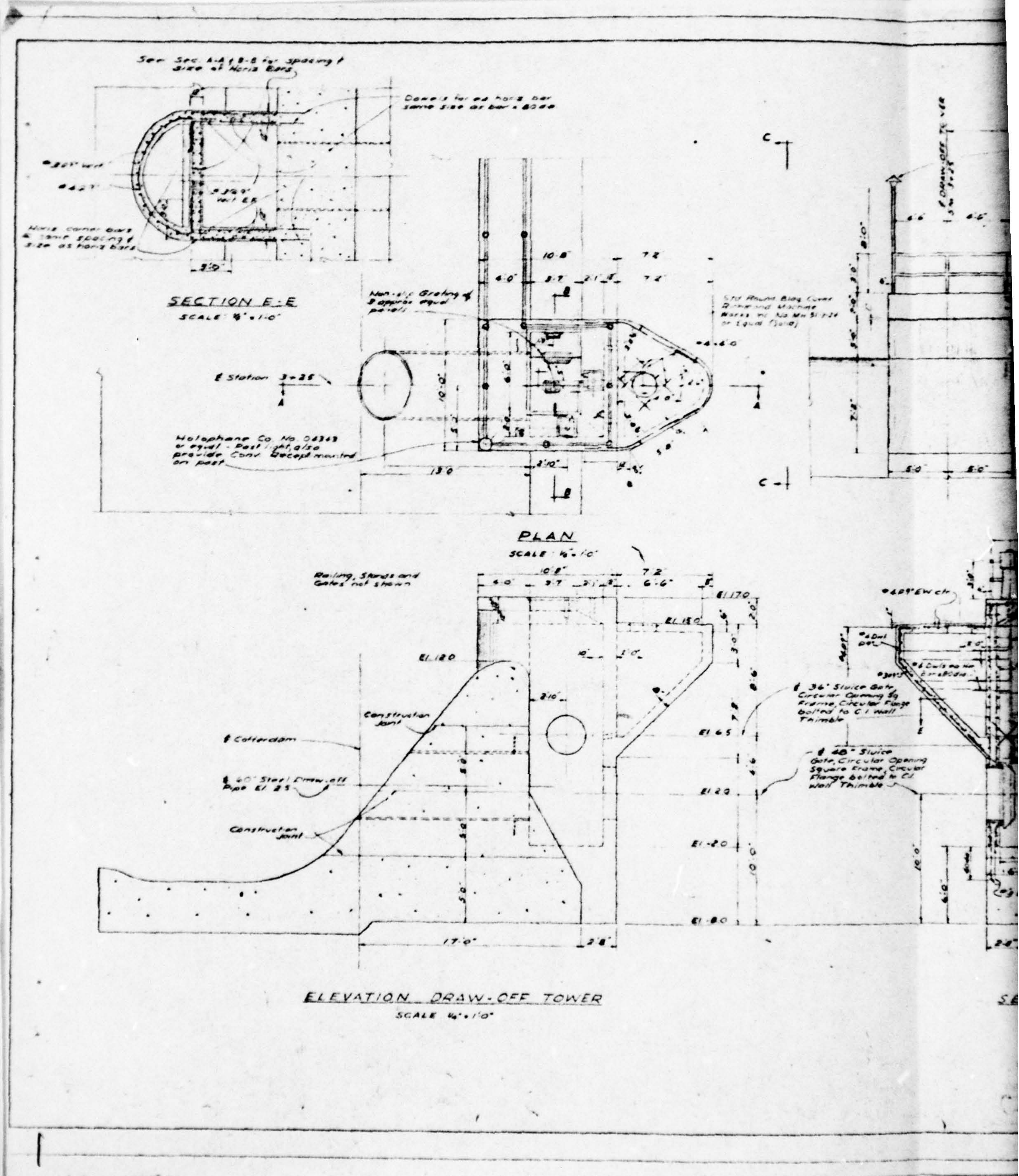
PLANS ARE NOT TO SCALE
PLATE NO. 4

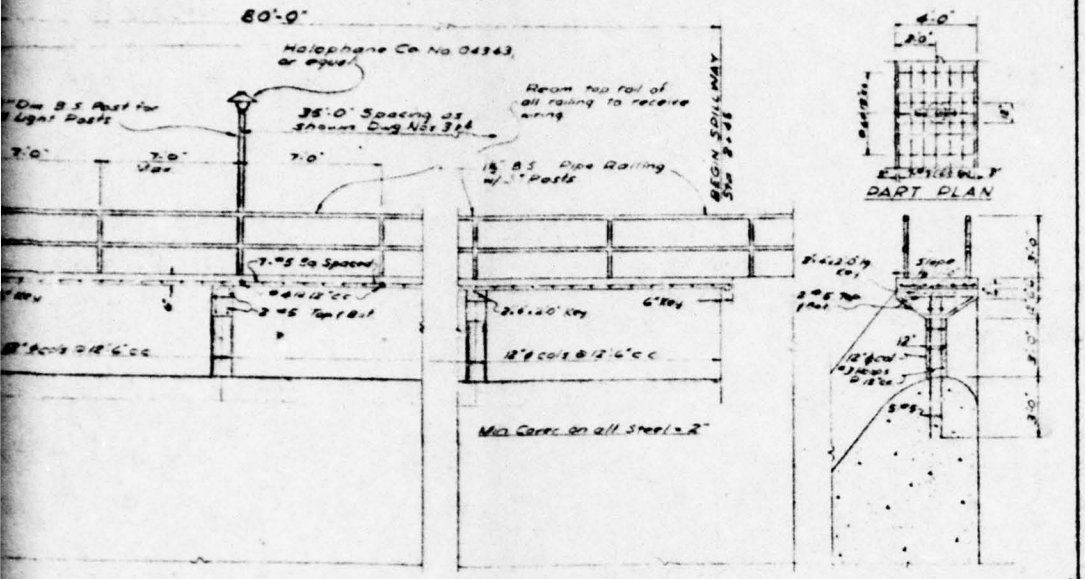
PART PLAN
NON-SPILLWAY SECTION
SCALE 1/16"=1'-0"

PORTSMOUTH WATER DEPARTMENT
LAKE MEADE DAM
STRUCTURAL
SECTIONS AND DETAILS

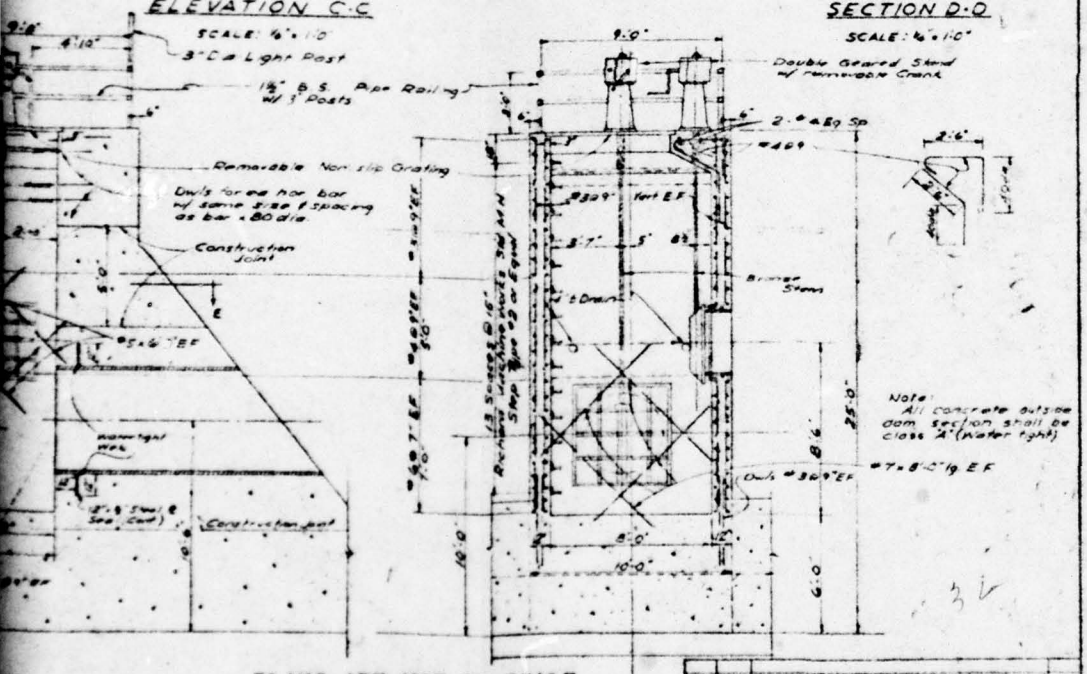
DES. WDM	R. KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA	SCALE AS SHOWN
DRN. WDM, GRW		
CHK. RKW	CONTRACT "A"	DWG. NO. 6
DATE 1/58	FILE NO. 3164	

LAKE MEADE DAM AND RESERVOIR


SECTION E-E
SCALE: ⅛" = 1'-0"
PLAN
SCALE: ⅛" = 1'-0"
ELEVATION DRAW-OFF TOWER
SCALE ¼" = 1'-0"
Railing, Stands and Gates not shown
Construction Joint
Construction Joint
℄ Cofferdam
Holophane Co. No. 04343 or equal - Post light, also provide Conv. Recept. mounted on post
℄ Station 3+25
Non-slip Grating of 3 approx. equal panels
℄ 36" Sluice Gate, Circular Opening Sq. Frame, Circular Flange bolted to C.I. Wall Thimble
℄ 48" Sluice Gate, Circular Opening Square Frame, Circular Flange bolted to C.I. Wall Thimble
El. 17.0
El. 15.0
El. 12.0
El. 6.5
El. 2.0
El. -2.0
El. -8.0



PART PLAN



PLANS ARE NOT TO SCALE
PLATE NO. 5

SECTION A-A
SCALE: 1/4" = 1'-0"

SECTION B-B
SCALE: 1/4" = 1'-0"

PORTSMOUTH WATER DEPARTMENT
LAKE MEADE DAM
STRUCTURAL
DRAW OFF TOWER

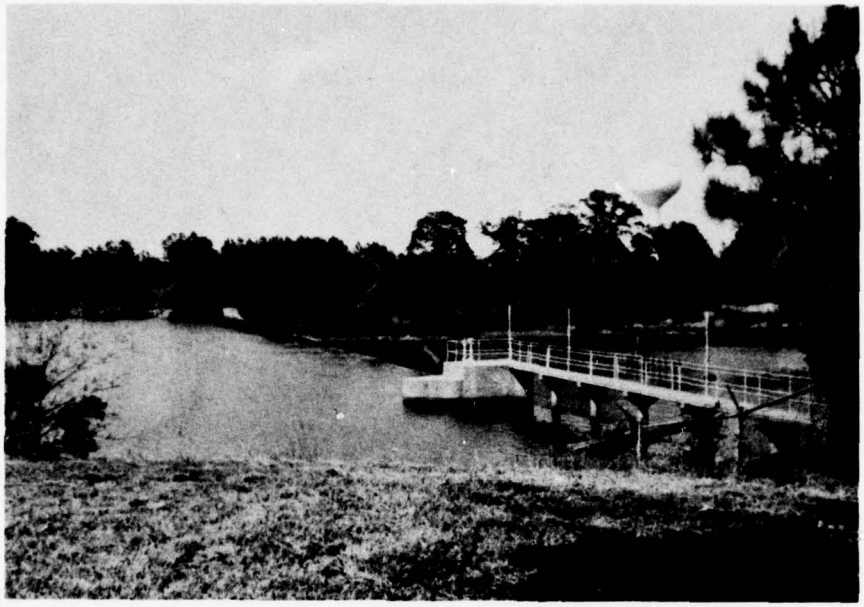
DES. WDM JWG	R. KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA	SCALE AS SHOWN
DRN. WDM		
CHK. RKW	CONTRACT "A"	DWG. NO. 7
DATE APRIL 1958		

LAKE MEADE DAM AND RESERVOIR

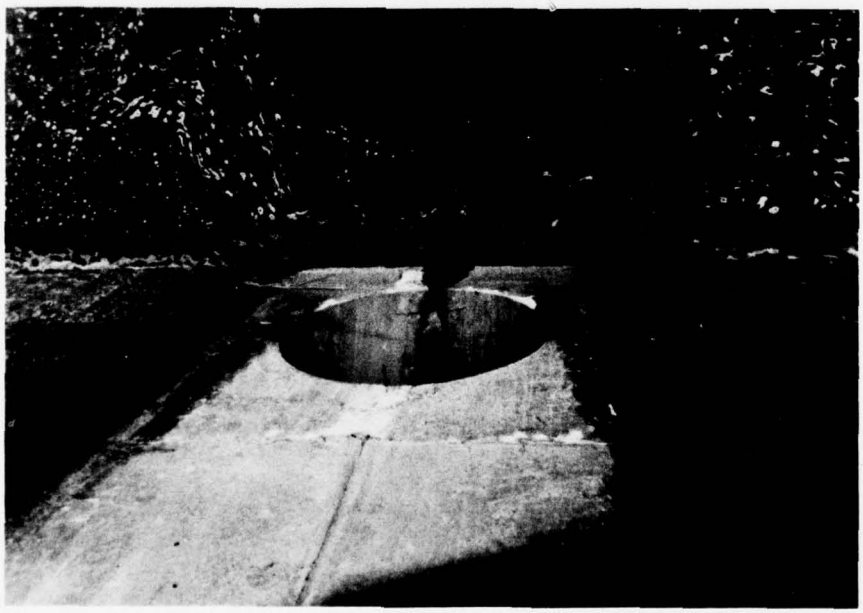
2

APPENDIX II

PHOTOGRAPHS

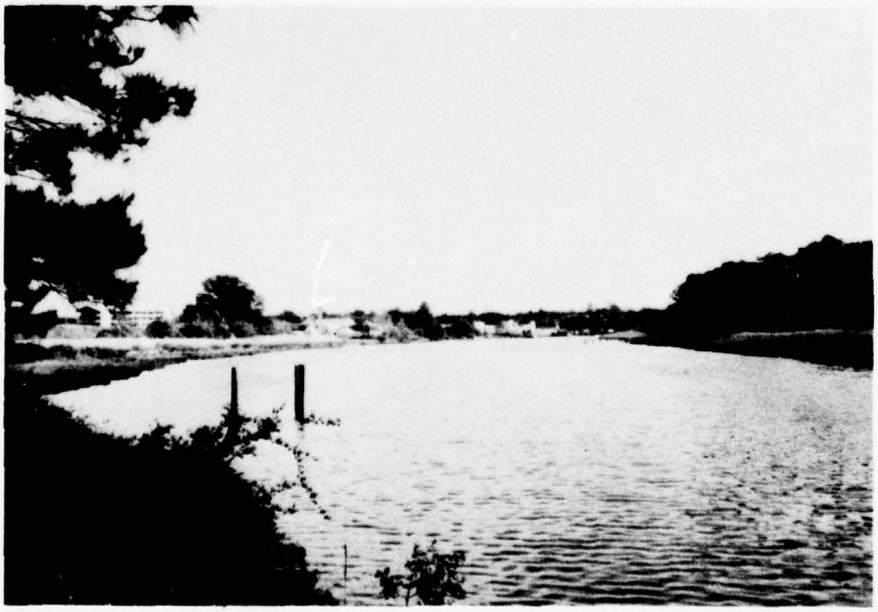


PHOTOGRAPH NO. 1
Walkway Structure



PHOTOGRAPH NO. 2
Discharging Culvert

PHOTOGRAPH NO. 3
Abutment



PHOTOGRAPH NO. 4
Downstream

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Lake Meade County City of Suffolk (formerly Nansemond Co.) State Virginia Coordinates Lat. 3644.8 Long. 7634.3

Date(s) Inspection 5/7/79 Weather Clear Temperature 74° F

Pool Elevation at Time of Inspection 12.0 M.S.L. Tailwater at Time of Inspection 0 M.S.L.

Inspection Personnel:

Leslie Nelms, Owner's Representative Lake Meade Dam
Mike Cowell-Law Engineering Soils and Geology
Robert Gay, P.E.- SWCB
Tan Young, P.E. - DMM&A Hydrology/Hydraulics

Paul Seiler, P.E.- DMM&A Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	White deposits on face of wall below the valve platform - dry at inspection. Left abutment - last span shows white deposits in horizontal joints. Dry when inspected. Wet joints below this elevation.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Right abutment- no obvious settlement, no erosion visible. Left abutment - no obvious settlement, no erosion visible.	
DRAINS	None.	
WATER PASSAGES	None.	
FOUNDATION	Dam is concrete gravitytype - foundations according to plans.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRAKCS CONCRETE SURFACES	Very small marks near joints along crest.	Need observation and repair at low water time.
STRUCTURAL CRACKING	None observed.	
VERTICAL AND HORIZONTAL ALIGHMENT	No obvious misalignment.	
MONOLITH JOINTS	Face of dam had water flowing - 3 transverse joints showed opening at crest. Horizontal joints right of center had spalling causing water to jump at joint	Tailwater is salty water.
CONSTRUCTION JOINTS		
ABUTMENT	No cracks or seepage visible at junction of concrete and earth abutment.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE		
OUTLET STRUCTURE	No cracking	
OUTLET CHANNEL		
EMERGENCY GATE	1-48" sluice gate at 2.0 and 1-36" sluice gate at 6.5.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS	Two on top of dam.	
WIERS	None.	
PIEZOMETERS	None.	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat. Forested	
SEDIMENTATION	Unknown.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Clear.	
SLOPES	Flat.	
APPROXIMATE NO. OF HOMES AND POPULATION	13 houses, estimated population of 35.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	See Appendix I
REGIONAL VICINITY MAP	See Appendix I.
CONSTRUCTION HISTORY	Built in 1959.
TYPICAL SECTIONS OF DAM	See Appendix I
HYDROLOGIC/HYDRAULIC DATA	
OUTLETS - PLAN and - DETAILS	See Appendix I
- CONSTRAINTS and - DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	

ITEM	REMARKS
DESIGN REPORTS	See References, Appendix IV.
GEOLOGY REPORTS	See Appendix I for boring plan
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Appendix V.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Appendices I and IV.
POST-CONSTRUCTION SURVEYS OF DAM	1978 by J. K. Timmons & Schnabel Engineering.
BORROW SOURCES	R. Kenneth Weeks, Engineers, Norfolk, VA.

ITEM	REMARKS
MONITORING SYSTEMS	Pool elevations records kept by the month.
MODIFICATIONS	
HIGH POOL RECORDS	1.5 feet over spillway observed.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1978 by J. K. Timmons Engineering and Schnabel Geotechnical Engineering.
PRIOR ACCIDENTS OF FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	By the City.

ITEM	REMARKS
SPILLWAY PLAN	See Appendix I
SECTIONS	See Appendix I
DETAILS	See Appendix I
OPERATING EQUIPMENT PLANS & DETAILS	

APPENDIX IV

GEOLOGICAL DATA

C. GEOTECHNICAL ENGINEERING

1. Introduction

Our scope of services for the Lake Meade Dam included site inspection, review of existing design data and engineering analysis. The Geotechnical Engineering analysis included evaluation of site inspection and related design data to develop a Phase I Inspection Report as outlined in the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" with respect to geotechnical engineering.

2. Phase I Study

a. Dam Geometry and Site Conditions

The Meade Dam was constructed in 1959 across the Nansemond River in Suffolk, Virginia. This concrete dam is supported on timber piles and has a cofferdam cutoff below. The dam is 677.5 ft in length with top of dam at El 17 and a center spillway 530 ft long with crest at El 12. The maximum height from the bed of the Nansemond River to the top of the dam is about 32 ft. The maximum water depth at normal pool is about 27 ft. All elevations refer to Portsmouth Water Department Datum (El 0.00 P.W.D. = USC & GS MSL Datum El +1.93).

b. Regional Geology

The dam is located in the Coastal Plain geologic province and is underlain by the Yorktown Formation of Miocene geologic age. The Yorktown consists generally of preconsolidated marine sand, clay and broken shell material known locally as "marl". Surrounding hilltops in the immediate dam area are probably capped with the Sedley formation of Pliocene geologic age. The Sedley is composed of fine sand and silty sand with thin layers of silty clay.

The dam is located in an area where the probability of seismic activity is low and is expected to cause only minor damage. Specifically the dam is located in a Zone 1 Seismic area as defined by the U. S. Army Corps of Engineers.

c. Review of Available Design Data

The construction drawings designated Contract "A", prepared by R. Kenneth Weeks, Engineers, Norfolk, Virginia and dated April 1, 1958, were reviewed in this study. Specifically Drawings 1 through 7 were included in our evaluation and Drawings 2, 3, 4, and 5 are included in Appendix D.

(1). Subsurface Conditions

Eleven test borings were drilled for design of the dam as shown on Drawing 2 . The generalized stratigraphy may be described as follows:

Stratum A: From the original marsh to El-7 to El-17	Gray organic silt and peat; soft (N=1 to 5)
Stratum B: From the ground surface and below Stratum A to El -5 and -29	Gray fine sand with vegetation; loose to firm (N = 2 to 7)
Stratum C: From the ground surface to El+6 to -13 in the north and south abutments, respectively	Gray and brown, fine sandy clay and fine to medium sand; stiff consistency and loose (N = 2 to 25)
Stratum D: Below Strata B and C to the maximum depth of penetration, El-51	Gray fine silty sand with trace of shells; loose to firm (N = 6 to 19)

Strata A and B are recent Nansemond River deposits. The soils of Stratum C located above each abutment are probably part of the Sedley Formation of Pleistocene geologic age. These soils and the recent river soils are underlain by Miocene Age soils of the Yorktown Formation designated Stratum D.

(2). Foundation and Cutoff Wall

The dam is supported on a cofferdam constructed of 18 semicircular steel sheeted cells with diaphragms each 30.5 ft long and two end cells about 62 ft in length. These cells penetrate to El-56.5 with top of cells at El+8 and provide a cutoff. The cells penetrate

a minimum of 29 ft into the "marl" of Stratum D. Beyond the end of the cofferdam, concrete cutoff walls extend into the abutments a distance of 79 ft on the south end and 59 ft in the north end. These walls extend to El-20. Each cell also contains 60 timber piles with 20 ton capacity. Pile tips were required to penetrate to about El-56.5 or the same tip grade as the cellular cofferdam.

In order to insure the stability of the cellular cofferdam wall, all soft marsh soils and the underlying loose sands of A and B respectively were dredged from within the cells and also to a distance of 30 ft upstream and downstream. Dredging was required to the surface of the "marl" of Stratum D. This excavated area was then backfilled with sand to El-6.

This foundation is certainly compatible with the geologic conditions at the site. Based on our review of the design, we believe the dam foundation is adequate for the loading condition. No stability analyses of the dam foundation soil complex were considered necessary.

d. Field Inspection

The Meade Dam was inspected by our personnel in August 1978 to observe the condition of the dam alignment and abutments.

(1). Foundation

The spillway was visually observed for horizontal and vertical alignment. Any indication of misalignment would indicate possible foundation problems. The alignment appeared to be excellent and the foundation is thus apparently functioning properly.

(2). Abutment Stability and Seepage

No instability or seepage was observed in either the north or south abutments. Riprap was noted to be inplace and functioning as designed on both abutments.

3. Conclusions and Recommendations

Based on the geotechnical engineering data contained in this report, the following summary of conclusions and recommendations is presented.

a. The Meade Dam contract drawings were reviewed with regard to the site foundation conditions. Noticable settlement was not observed along the spillway indicating this foundation is functioning as planned.

b. The dam was inspected using the U. S. Army Corps of Engineers guidelines for abutment and seepage problems. No seeps were noted along abutments as described here. Both abutments appear stable and dam is functioning as planned with respect to geotechnical engineering considerations.

III. LAKE MEADE DAM SAFETY INSPECTION

A. CIVIL - HYDROLOGY

1. Description of Dam

The Dam is a concrete structure constructed in 1959. The structure is approximately 677.5 ft. long. The top elevation of spillway is 12.00. The location is on the Nansemond River and the base is subject to tidal action.

The picture below shows view from walkway atop spillway looking north.

CONCRETE SPILLWAY LAKE MEADE

This dam is a part of the Portsmouth water supply system. The elevation of water is controlled by the dam located on Lake Cohoon. This water level is maintained so that a raw water pump located at its upper end (Lake Kilby Dam) can supply the water treatment plant located there. The total storage capacity of the Lake is 2,100 M.G.

Dams are classified by The Corps of Engineers in accordance to size and hazard potential. The classification will be used to determine the recommended design flood that the spillway must pass.

Lake Meade size classification is intermediate since the storage capacity is greater than 1000 acre-feet and less than 50,000 acre-feet. The hazard potential classification is high since there would be an excessive loss to the community, industry and agriculture due to the possible loss of the water supply. The downstream side of spillway has a large broad area which indicates no hazard to flooding of housing or danger to life for some distance downstream.

By The Corps of Engineers' criterion, a high hazard, intermediate-size dam must be able to pass the probable maximum flood (PMF) through the spillway.

A probable maximum flood by Corps of Engineers' standards is a flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. (See Storm Intensity Comparison Table following Physical Inspection Section.)

The State of Virginia adopted Regulation No. 9 for impounding structures in March 1978 which was filed in May 1978 and became effective July 1, 1978. This regulation states that within one year from effective date, every owner of an existing impounding structure, shall provide data and information to the State Water Control Board sufficient to enable the Board to determine whether to issue an Operations and Maintenance permit for existing impounding structure, or to direct such work as may be necessary to mitigate extant hazard to life and property attributable to the existing structure. The procedures for this can be found in the copy titled, "Impounding Structure Regulations", Chapter 12, Page RB-6-11. (See Appendix). The sections which have been underlined in this Regulation should be given attention since they pertain to requirements, findings, actions by the Board, right to hearing on suggestions, and enforcement.

As stated in the Regulation, if a formal complaint is filed, due to unsafe conditions or operating conditions and is found to be true by the Board, the owner shall be required to place the facility in a safe condition as suggested or the Board shall cause such action to

be taken as breaching or removal of any impounding structure found beyond repair. As the guidelines indicate in this regulation, the following findings were acquired for this impounding structure titled, Lake Meade Dam.

2. Physical Inspection

(a) Procedure

During the month of September, 1978, this site was inspected by engineering personnel from J. K. Timmons & Associates. At the time of inspection and photographing, the water was below spillway crestline. This allowed, with the use of a boat, a visual inspection of the downstream side of spillway. The cut-off walls were also observed on either end of the spillway. The joints which were reachable from boat level were inspected and photographed. With the use of plans and by counting the expansion joints, the cracks and leaks were located. This spillway showed little weathering affect and with the use of the Appendix, the Cracks Location Map shows problem areas.

In general, the walkway atop spillway to gate was inspected, downstream spillway, and end walls were viewed, along with upstream bedding and banks.

(c) Findings

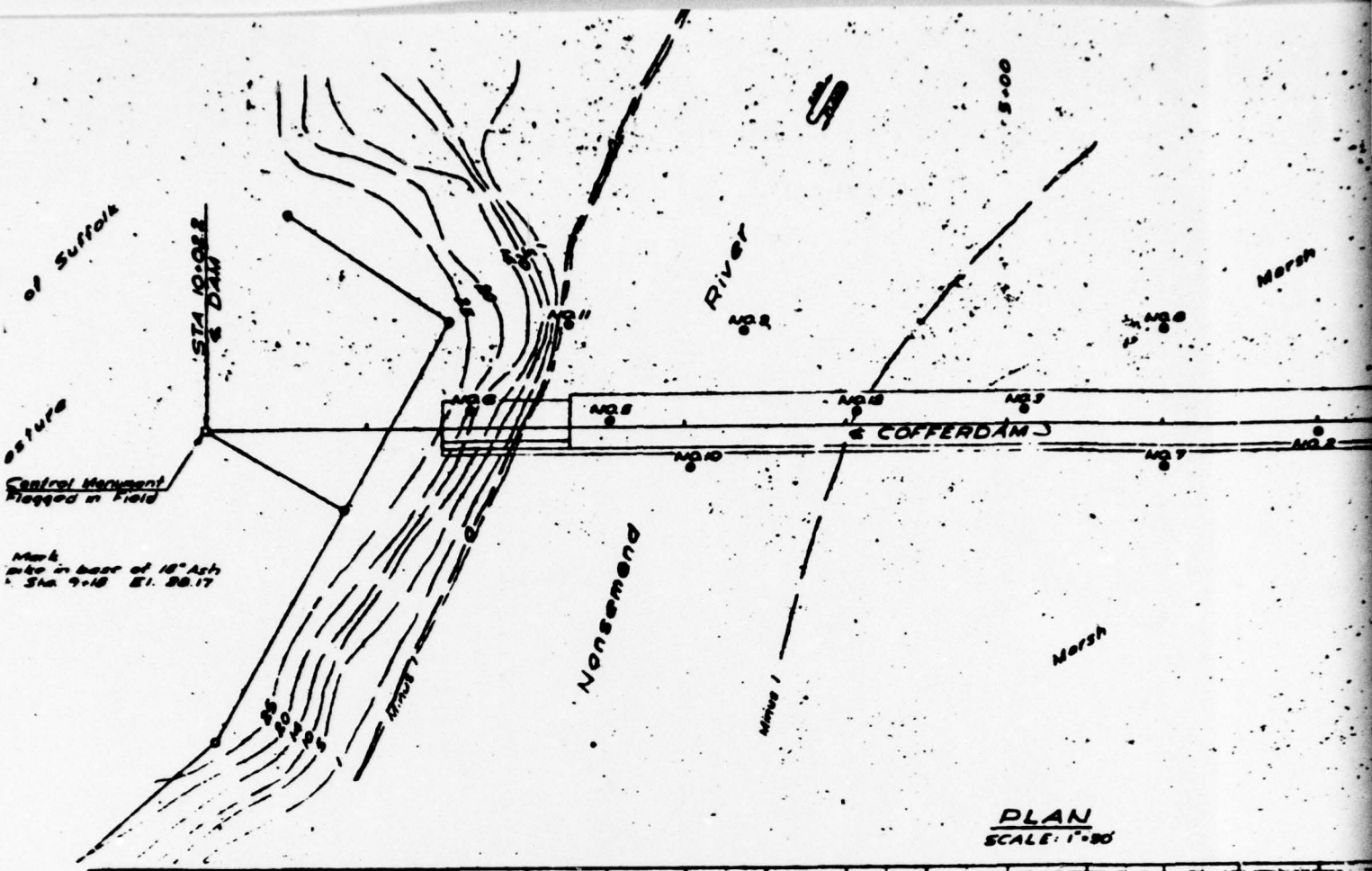
1. Spillway

The general condition was found to be excellent. The downstream surface showed very little weathering affect. Some areas showed loss of aggregate but this was only minor. (See Photo #48) The only problems observed were those of bad joint compound allowing seepage. (Photos 47, 48, 51 and 52) Some cracks were observed but did not pose any real problem areas. (Photos 50 and 53) It was also noted that the lights had been removed, but wiring and power source are still available. (Photos 49 and 50) The top of gate fence is also in need of new wire. The surface of concrete was found to be in excellent condition (by soundings to end wall and spillway surface). The gates located at the end of walkway seemed to be greased and in good working condition. Little trash was seen at the bottom of tower and if these gates were open, they would clean themselves. Steel handrail was found to need a coat of paint. (Photo 49).

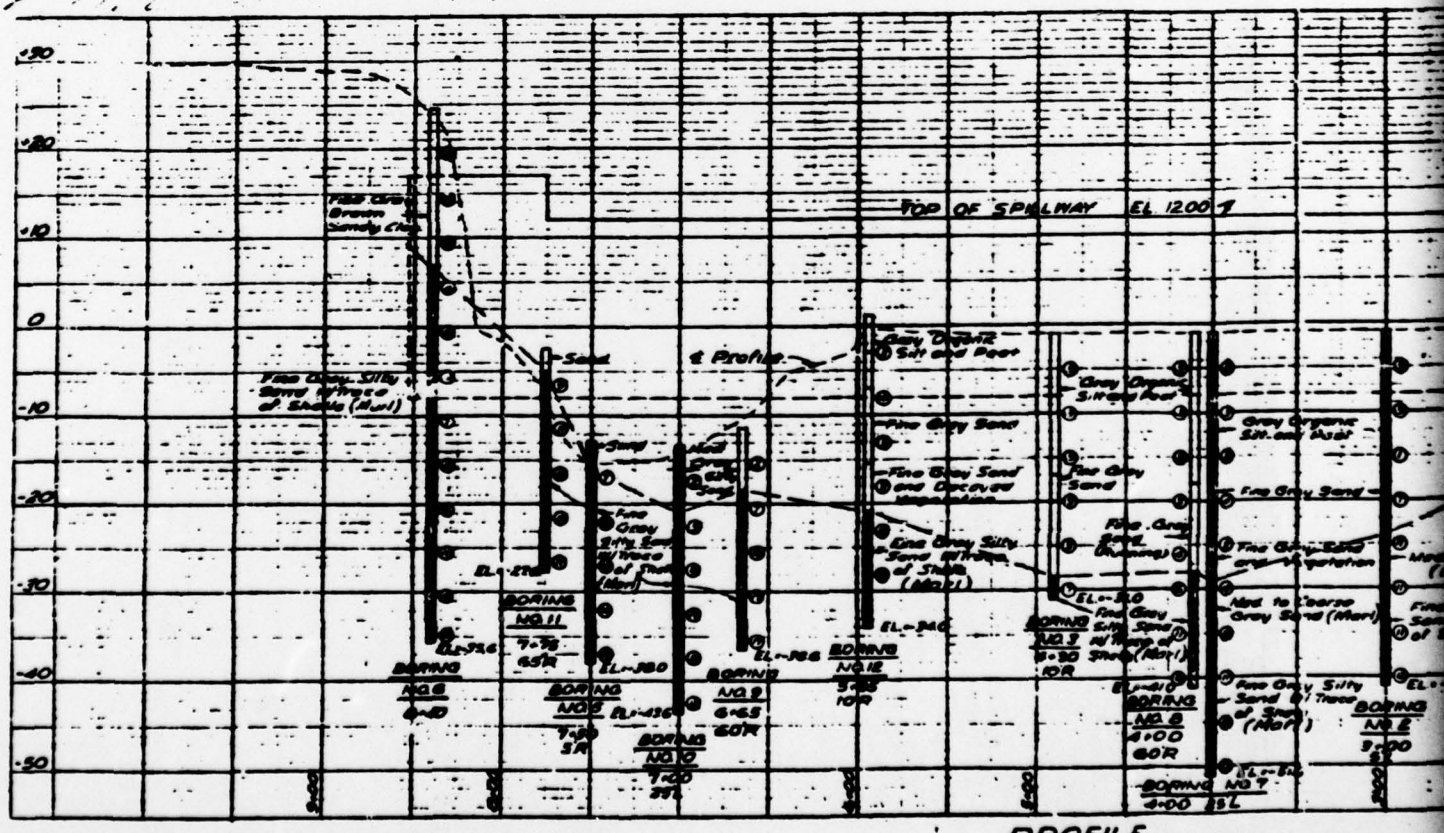
Appendix should be consulted for location of bad joints and cracks. The following code is used to describe the cracks.

P.H. - Pothole - Requires Repair
D.C. - Dry Crack - Requires Sealing
W.C. - Wet Crack - Requires Cutting Out and Sealing
L.J. - Leaky Joint - Requires Sealing
B.J. - Bad Joint Compound - Requires New Joint Compound
H - Hole Over 2" Deep - Requires new concrete and Tie to Old Surface
B.C. S. - Bad or Flaking Concrete Surface - Requires that surface should be Scaled and Plastered.

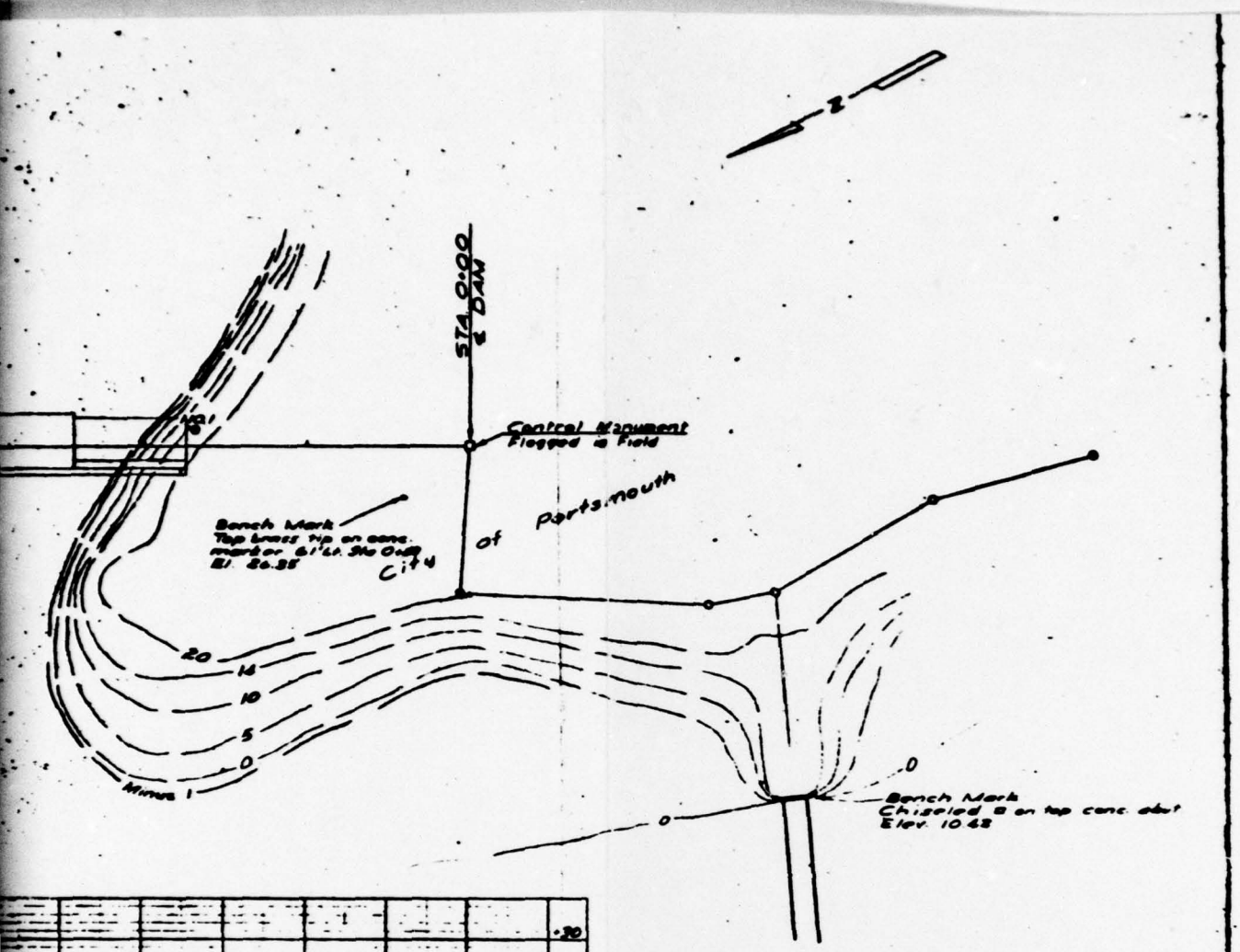
The Geotechnical Section should be consulted for a detailed opinion of foundation system of this structure.

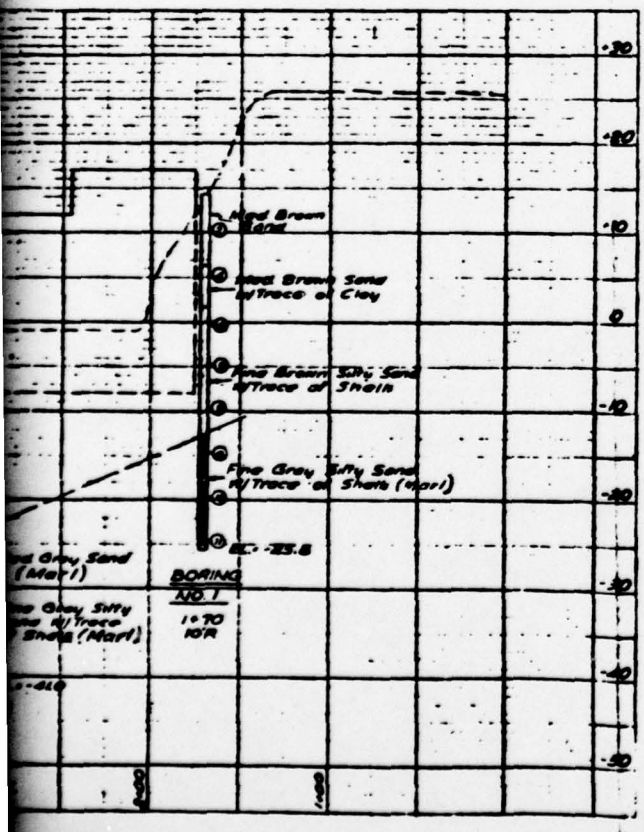


PLAN
SCALE: 1"=30'



PROFILE
SCALE: HORIZ. 1"=30'
VERT. 1"=10'





NOTES

1. All elevations are referred to Portsmouth Water Department Datum Elevation 0.00 PWD is equal to El 1.93 USC&GS [illegible]
2. ● = Blows required to drive [illegible] pipe one foot using a 140 lb weight falling 30 inches.

PLATE NO. 1

	1/4/66 Revised for Contract Set	
PORTSMOUTH WATER DEPARTMENT		
LAKE MEADE DAM		
ALIGNMENT AND BORING PLAN AND LOGS		
DES RKW	R KENNETH WEEKS ENGINEERS NORFOLK, VIRGINIA	SCALE AS SHOWN
DRN GRW		
CHK RKW	CONTRACT "A"	DWG NO 2
DATE FEB 1968		

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APPENDIX V

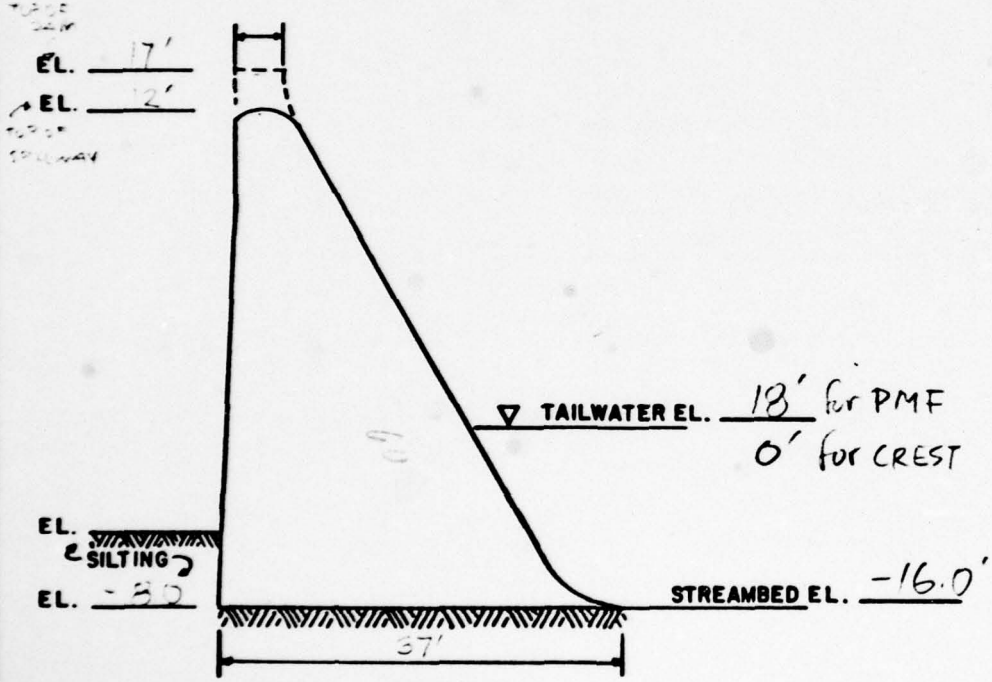
STABILITY ANALYSIS

GRAVITY DAM DESIGN
STABILITY ANALYSIS

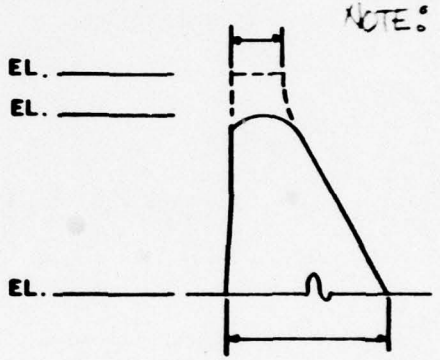
ANALYSIS DONE ON ✓ FULL SECTION ___ PARTIAL SECTION
LOCATION OF SECTION STA 5+00
ANALYSIS PREPARED BY

LOADING CASE	ELEV. HEAD WATER	ELEV. TAIL WATER	ΣV	ΣH	ΣH/ΣV	LOCATION RESULTANT FROM TOE	% BASE IN COMPRESSION	FACTOR SAFETY SLIDING	FOUNDATION PRESSURE	
									TOE	HEEL
PMF	24'	18	24.74 ↓	10.875 ←	0.44	16.2'			33 K/PILE	10.5 K/PILE
CREST OF SPILLWAY	12'	0	29.64 ↓	12.5 ←	0.42	20.5'			34.4 K/PILE	15.6 K/PILE

NOTE: 20 TON PILES



FULL SECTION



PARTIAL SECTION

APPENDIX V

REFERENCES

LIST OF REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20316.